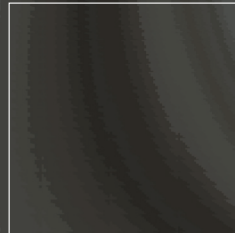


# Modifications to Mangoola Coal Mine Plans and Relocation of 500kV Electricity Transmission Line

environmental



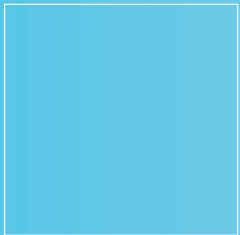
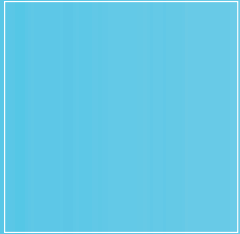
assessment



DECEMBER 2010

**VOLUME 3**

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## Appendix C1

## Ecological Assessment

Xstrata Mangoola Pty Limited

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# **Ecological Assessment – Proposed Mine Plan Modification, Mangoola Coal**

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December 2010

# **Ecological Assessment – Proposed Mine Plan Modification, Mangoola Coal**

**Prepared by**  
**Umwelt (Australia) Pty Limited**  
**on behalf of**  
**Xstrata Mangoola Pty Limited**

|                   |                  |                     |
|-------------------|------------------|---------------------|
| Project Director: | Barbara Crossley |                     |
| Project Manager:  | Travis Peake     |                     |
| Report No.        | 2497/R15/Final   | Date: December 2010 |



2/20 The Boulevard  
PO Box 838  
Toronto NSW 2283

Ph: 02 4950 5322  
Fax: 02 4950 5737  
Email: [mail@umwelt.com.au](mailto:mail@umwelt.com.au)  
Website: [www.umwelt.com.au](http://www.umwelt.com.au)

## Executive Summary

This Ecological Assessment documents the impacts associated with the proposed mine plan modification to the approved Mangoola Coal Project (Project Approval 06\_0014), located in the Wybong area, 20 kilometres west of Muswellbrook and approximately 10 kilometres north of the township of Denman.

The Ecological Assessment identifies and assesses the potential impacts of the project on threatened flora and fauna species, endangered populations and threatened ecological communities (TECs), or their habitat, in accordance with the NSW *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act), *Environmental Planning and Assessment Act 1979* (EP&A Act), as well as the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### Proposed Modification Areas

The proposed modifications to the mine plan include six Proposed Modification Areas encompassing a total area of approximately 11.7 hectares. Five of the Proposed Modification Areas fall within the Biodiversity Offset Areas defined in the Anvil Hill Project Environmental Assessment (EA) (Umwelt 2006). The remaining Proposed Modification Area (Area 2) falls outside of the Biodiversity Offset Areas. The approved project disturbance area and Biodiversity Offset Areas were extensively surveyed as part of the Anvil Hill Project EA (Umwelt 2006), and the information from those surveys has been used to inform the current Ecological Assessment. The approved project disturbance area at Mangoola Coal covers approximately 2283 hectares.

### Methods

A detailed survey methodology was designed and implemented in order to gain a thorough understanding of the ecological features of the Proposed Modification Areas. The methods used as part of the current project build on the extensive amount of existing knowledge of the area, gained from the Ecological Assessment completed for the Anvil Hill Project EA (Umwelt 2006), as well as various other studies undertaken at Mangoola Coal.

The methods used for the current project comprise a detailed literature review as well as searches of a variety of relevant ecological databases. Information gathered from this stage was then used to design a field survey program to identify threatened flora and fauna species, endangered populations, TECs, or their habitats within each of the Proposed Modification Areas.

The flora surveys incorporated non-quantitative transects that traversed each of the Proposed Modification Areas, to ground-truth existing vegetation mapping (Umwelt 2006) and to complete targeted threatened flora surveys. The flora surveys were undertaken in accordance with the DEC *Draft Threatened Species Survey and Assessment Guidelines* (DEC 2004).

The fauna surveys completed for the current project were limited, due to the small size and limited habitats of the Proposed Modification Areas and the existing knowledge of the fauna assemblage of the area (Umwelt 2006). Surveys included opportunistic recording of species encountered while completing flora surveys, as well as mapping of habitat features, particularly for threatened species.

### Flora Results

Surveys of the Proposed Modification Areas identified three vegetation communities. The Disturbed Grassland community is the most widespread community within the Proposed

Modification Areas, comprising a total of 5.1 hectares. Slaty Box Woodland occurs entirely within Proposed Modification Area 1, comprising a total of 5.4 hectares. Ironbark Woodland Complex occurs only within Proposed Modification Area 2, covering 1.2 hectares. The Ironbark Woodland Complex is consistent with a TSC Act-listed EEC and the Slaty Box Woodland is consistent with a TSC Act-listed vulnerable ecological community (VEC).

One threatened flora species was recorded in the Proposed Modification Areas, being tricolour diuris (*Diuris tricolor*). This species is also listed as an endangered population under the TSC Act. There were 122 individuals of this species recorded within Proposed Modification Area 1, although only three individuals will be impacted as a result of the project due to the redesigning of this area to avoid this substantial population.

## Fauna Results

A total of 30 fauna species were identified during opportunistic surveys undertaken for this project. This included 24 bird species, and 6 mammal species.

No threatened fauna species were recorded within the Proposed Modification Areas as part of the current survey. Despite this, a number have the potential to occur within the Proposed Modification Areas, particularly within the woodland habitats of Proposed Modification Areas 1 and 2.

The Woodland habitat provides a variety of habitat resources for fauna species. In particular, the blossoming *Eucalyptus* spp. provides foraging resources for nectarivorous and insectivorous species. This would include threatened mammals such as the squirrel glider (*Petaurus norfolcensis*), and a wide diversity of micro-bat species known to occur in the area. There was no aquatic habitat present within the Proposed Modification Areas, reducing potential for amphibian species.

The Grassland habitat provides a greatly reduced variety of habitat niches for fauna species. No remnant trees were present within this habitat type in Proposed Modification Areas 3 to 6, however they were present in Proposed Modification Areas 1 and 2. Very low levels of terrestrial cover (in the form of logs, boulders and shrubby vegetation) were present. Due to the distance between the habitats of Proposed Modification Areas 3 to 6 and stands of remnant vegetation, it is not likely that edge-foraging fauna species (such as robins) would utilise these habitats to a great degree.

## Impacts

Of the 11.7 hectares of vegetation to be removed as part of the Proposed Modification Areas, 5.1 hectares (44 per cent) comprised of Disturbed Grassland, where substantial clearing and existing disturbances have already reduced the biodiversity value of this community. The remaining 56 per cent of vegetation to be removed comprises two communities of higher quality woodland vegetation comprising two communities, each of which is listed under the TSC Act.

Given the general lack of canopy and understorey strata, the Disturbed Grassland community is unlikely to be significantly impacted by the project. While this community is known to contain habitat for a number of threatened species (such as tricolour diuris, *Diuris tricolor*), it is not likely to be of high conservation significance in its own right. The project is not likely to result in a significant reduction in the amount or quality of Disturbed Grassland in a local or regional context.

Approximately 1.2 hectares of Ironbark Woodland Complex and 5.4 hectares of the Slaty Box Woodland will be removed as a result of the proposed modification. Both of these communities are of conservation significance, as they are both consistent with listed TECs.

Due to the nature of the project, all vegetation within the Proposed Modification Areas will be removed, including the three recorded individuals of tricolour diuris (*Diuris tricolor*) and associated potential habitat. There are no other recorded threatened flora species that are considered to have a reasonable potential to be impacted by the project.

Impacts on fauna species from the project are likely to arise from the removal of vegetation, particularly hollow-bearing trees. Approximately 20 hollow-bearing trees were observed in Proposed Modification Areas 1 and 2, and it is likely that all of these would require removal.

Significance assessments undertaken in accordance with the TSC Act and the EPBC Act have found that the project is not likely to result in a significant impact on any occurring or potentially occurring threatened species, endangered populations, TECs or their habitats.

### **Impact Mitigation Strategy**

The project has been designed and revised to avoid identified impacts on significant ecological features of the Proposed Modification Areas, where possible. This has included the redesign of the largest Proposed Modification Area (Area 1) to exclude and protect a substantial population of tricolour diuris (*Diuris tricolor*). This avoidance has served to greatly reduce the impact of the project on this threatened species, and the endangered population of which these records are part.

The loss of up to 11.7 hectares of vegetation within the Proposed Modification Areas is not likely to result in major impacts on the biodiversity of the local area. Despite this, it is appropriate to implement mitigation measures for those impacts that have not been able to be avoided and will occur as a result of the project. These impact mitigation measures include the formal protection and management of the substantial population of tricolour diuris (*Diuris tricolor*), the implementation of pre-clearing surveys and installation of nest boxes to replace all hollows lost as a result of the Project.

### **Biodiversity Offset Strategy**

In order to address residual impacts of the project on threatened species, endangered populations, TECs and their habitats, a Biodiversity Offset Strategy has been developed for the Proposed Modification Areas. The Biodiversity Offset Strategy will include a 34 hectare portion of the former 'Nipol' property (referred to as the Additional Biodiversity Offset Area). This portion of the property being proposed for this offset adds to the existing proposed offset from the 500 kV relocation project (being 30 hectares), extending the vegetated linkage along the western side of the property between the Conservation Offset Area of the Mangoola Mine to the vegetated habitats of the Myambat Military Area. The Additional Biodiversity Offset Area will be subject to the same ongoing management actions as the existing Biodiversity Offset Areas, to ensure its ecological integrity in the long term.

### **Summary and Conclusion**

The significance assessments found that the project is not likely to result in a significant impact on any occurring or potentially occurring threatened species, endangered populations, TECs or their habitats within the Proposed Modification Areas.

The Biodiversity Offset Strategy has been designed to address residual ecological impacts associated with the proposed mine plan modification project. In combination, the impact mitigation and biodiversity offsetting proposed as part of this project seeks to achieve the overall goal to maintain or improve the biodiversity values of the local area.

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- E      Assessment of Significance – EPBC Act**

## 1.0 Introduction

This report documents an impact assessment prepared for the proposed modifications to the approved Mangoola Coal Project (Project Approval 06\_0014), located in the Wybong area, 20 kilometres west of Muswellbrook and approximately 10 kilometres north of the township of Denman (**Figure 1.1**).

### 1.1 Background to Project

Planning approval was granted to construct an open cut coal mine for the (then) Anvil Hill Project in June 2007. The mine, then owned by Centennial Coal, was approved to extract up to 10.5 million tonnes per annum (Mtpa) of run of mine (ROM) coal for 21 years. The approved project disturbance area for the Mine is depicted in **Figure 1.2**. In October 2007, the mine was purchased by Xstrata Mangoola Pty Limited, a wholly owned subsidiary of Xstrata Coal (NSW) Pty Limited, trading as Mangoola Coal.

Mangoola Coal is currently constructing the coal handling preparation plant and infrastructure areas, and mining commenced in September 2010. Mangoola Coal is now seeking to modify its mine plans that were approved under the current Project Approval 06\_0014 (PA 06\_0014). As part of this proposed modification, Mangoola Coal is seeking to include six Proposed Modification Areas (hereafter referred to as the Proposed Modification Areas 1 to 6) to the approved project disturbance area (see **Figure 1.3**).

This Ecological Assessment forms part of a larger Environmental Assessment (EA) prepared to support the application for modification. This modification seeks to increase the approved project disturbance area for the Mangoola Coal Project in the six nominated areas. Modifications are also proposed to the mine plan, water management, change in employee numbers, and establishment of a temporary ROM pad. However, these changes all relate to areas within the approved project disturbance area. Project approval was premised on the basis of complete disturbance within the approved project disturbance area and, as such, this Ecological Assessment focuses on the areas where additional disturbance is proposed outside of the approved project disturbance area. The Proposed Modification Areas comprise an area totalling 11.7 hectares or 0.5 per cent of the approved project disturbance area.

Mangoola Coal is the applicant for the project, and is seeking to modify the existing PA 06\_0014 under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Minister for Planning is responsible for approving projects under this section.

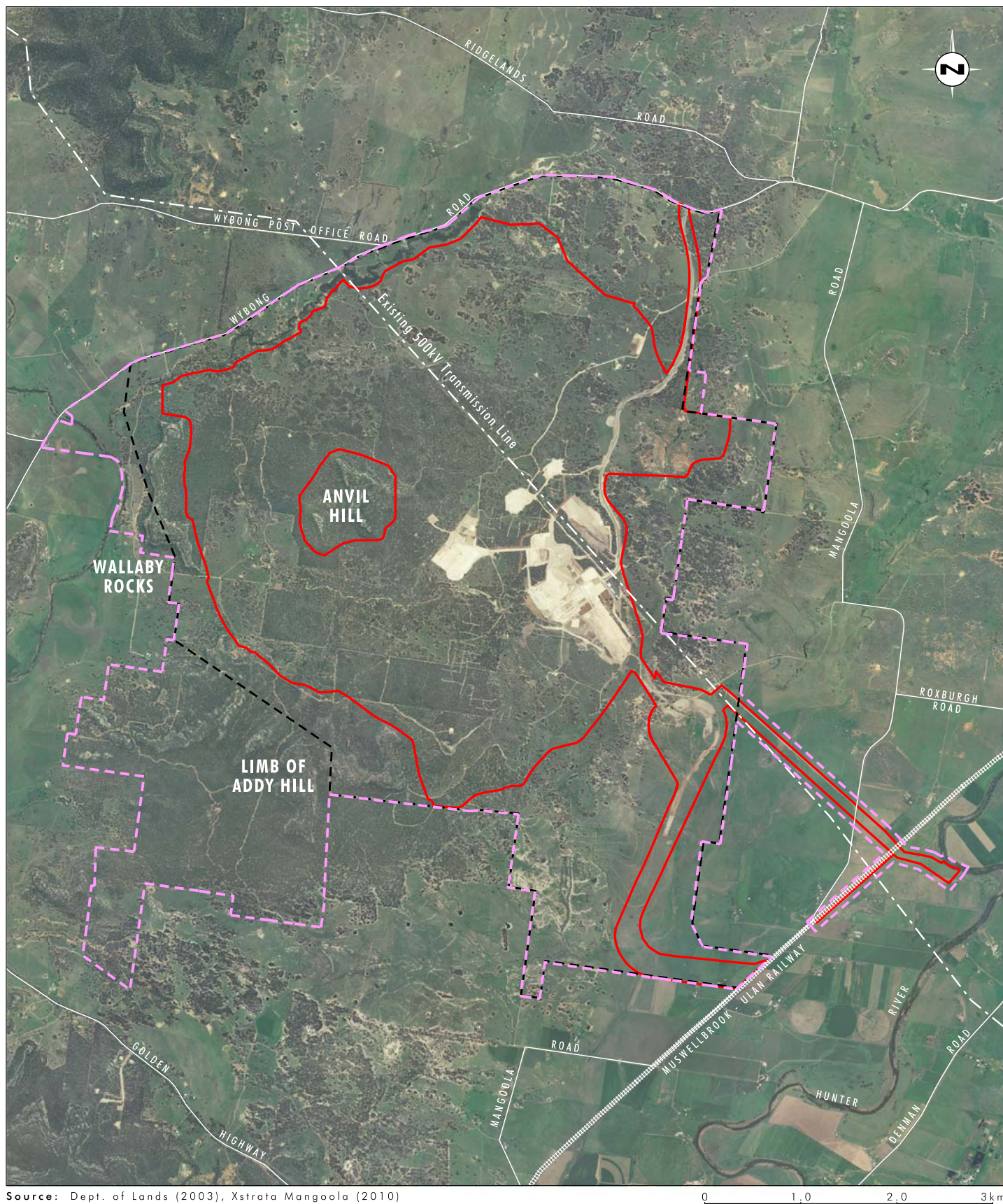
### 1.2 Proposed Modification Areas

A total of six modifications to the approved project disturbance area are being proposed as part of this project. The purposes of these Proposed Modification Areas are to provide for:

- an area of approximately 8.4 hectares where drilling has established that the coal crop line extends beyond the approved project disturbance area (Proposed Modification Area 1). It is proposed to extend open cut mining into this area in order to extract the identified coal resources and allow for maximum reserve recovery. Open cut mining involves the bulk removal of all topsoil and therefore the disturbance to any ecological features which may be present in this area. As part of this project, the extent of this area was reduced (from that which was originally proposed) in response to the identification of



FIGURE 1.1  
Locality Plan

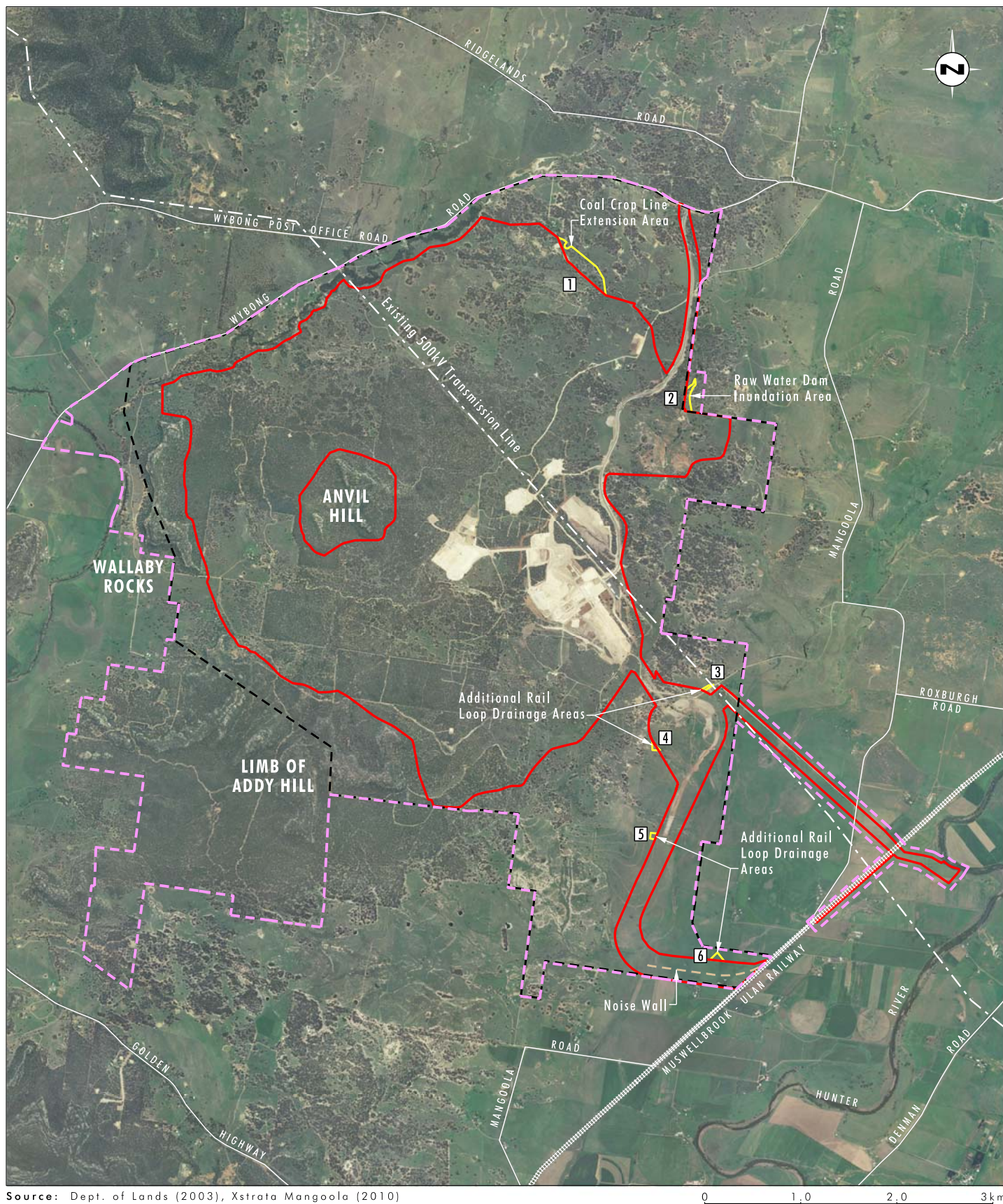


#### Legend

- Approved Project Disturbance Boundary
- Mining Lease 1626 Boundary
- Project Area

FIGURE 1.2

Approved Project Disturbance Area



#### Legend

- Approved Project Disturbance Boundary
- Mining Lease 1626 Boundary
- Modified Project Disturbance Boundary
- Project Area
- Existing 500kV Transmission Line

FIGURE 1.3

Proposed Modification Areas

a population of the threatened orchid, *Diuris Tricolor*, in this Proposed Modification Area. The alteration to this boundary resulted in a reduction of the area from 8.7 hectares to the current 8.4 hectares, thereby substantially reducing impact on this threatened flora species. This issue is discussed further in **Sections 3.3.3.1** and **5.1.1.1**;

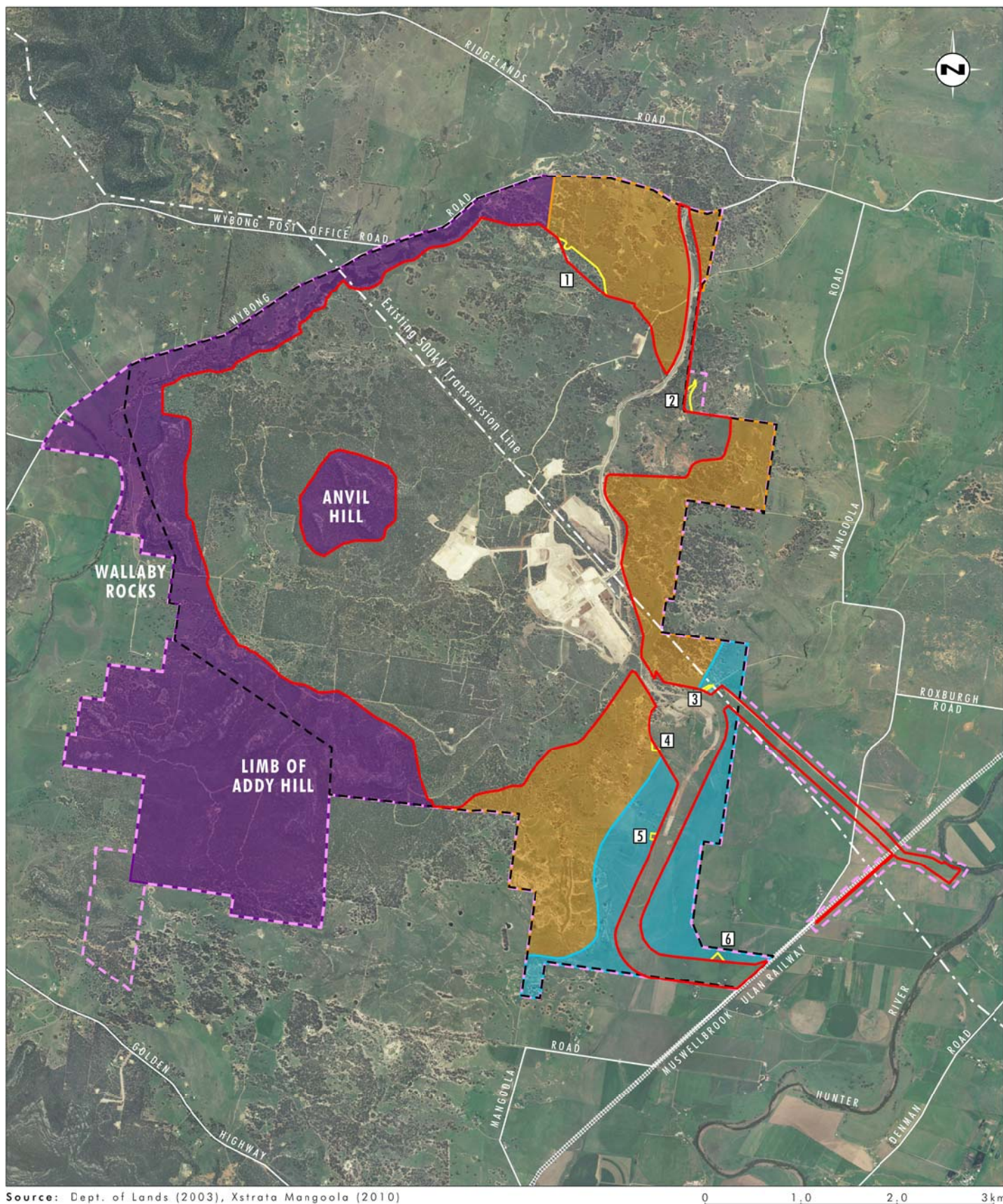
- an area of approximately 1.7 hectares where the raw water dam will inundate land at full supply (Proposed Modification Area 2). This will involve an increase in the footprint of an approved raw water dam so that it operates at full supply level (187 mAHD). The extent of inundation will extend beyond the approved project disturbance area. This inundation will result in disturbance to the majority of the ecological features of this area, particularly in relation to inundation of vegetation and loss of existing habitat; and
- four small areas (with a total area of approximately 1.6 hectares), where rail loop drainage designs need to be modified (Proposed Modification Areas 3 to 6). These areas involve the proposed construction of drainage features surrounding the approved rail loop. The drainage features may include small culverts, drains and clean water diversions that are required to ensure adequate separation of clean and dirty water from the rail loop. The construction and ongoing operation of these structures will involve the removal of all vegetation within these defined locations.

This report provides an assessment of the impacts of each of the Proposed Modification Areas (**Figure 1.3**) on ecological values. Details on each of the Proposed Modification Areas are provided in **Table 1.1**.

All of the Proposed Modification Areas except for one (see **Table 1.1**, below) occur within existing Habitat Enhancement Offset or Sustainable Agriculture Offset, as defined by the Anvil Hill Project EA (Umwelt 2006) (**Figure 1.4**). The Biodiversity Offset Areas were subject to detailed ecological survey and assessment as part of the Anvil Hill Project EA (Umwelt 2006). However parts of these were resurveyed as part of this current project in order to provide updated data on the ecological features of each of the Proposed Modification Areas. All relevant information gained from the Anvil Hill Project EA (Umwelt 2006), as well as other ecological documents completed as part of the project, has been used to inform this Ecological Assessment.

**Table 1.1 – Size of Proposed Modification Areas**

| Proposed Modification Area | Purpose of Proposed Modification Area | Size (Hectares) | Relevant Biodiversity Offset Area |
|----------------------------|---------------------------------------|-----------------|-----------------------------------|
| 1                          | Coal crop line extension area         | 8.4             | Habitat Enhancement Offset        |
| 2                          | Raw water dam inundation area         | 1.7             | N/A                               |
| 3                          | Additional rail loop drainage area    | 0.2             | Sustainable Agriculture Offset    |
| 4                          | Additional rail loop drainage area    | 0.4             | Habitat Enhancement Offset        |
| 5                          | Additional rail loop drainage area    | 0.4             | Sustainable Agriculture Offset    |
| 6                          | Additional rail loop drainage area    | 0.6             | Sustainable Agriculture Offset    |
| Total                      |                                       | 11.7            |                                   |



#### Legend

- Approved Project Disturbance Boundary
- Mining Lease 1626 Boundary
- Modified Project Disturbance Boundary
- Project Area
- Habitat Enhancement Offset Area
- Sustainable Agriculture Offset Area
- Conservation Offset Area

File Name (A4): R15\_V1/2497\_275.dgn

FIGURE 1.4

Approved Biodiversity Offset Areas

## 1.3 Objectives of Ecological Assessment

This Ecological Assessment has been prepared to assess the potential impact of the project on threatened flora and fauna species, endangered populations and threatened ecological communities (TECs), or their habitats, occurring within the Proposed Modification Areas.

The objectives of the ecological assessment were to:

- document the flora and fauna assemblages of the Proposed Modification Areas;
- document the fauna habitat types present within the Proposed Modification Areas;
- identify any threatened species, endangered populations, TECs, or their habitats, listed under the *Threatened Species Conservation Act 1995* (NSW) (TSC Act), the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) or the *Fisheries Management Act 1994* (NSW) (FM Act) within the Proposed Modification Areas;
- assess the potential impact of the project on any recorded or potentially occurring threatened species, endangered populations, TECs, or their habitats within the Proposed Modification Areas in accordance with the requirements of the EP&A Act and the EPBC Act;
- provide management options to minimise ecological impacts associated with the Project, including modifications to the design or operation of the Project, and other on-site impact mitigation; and
- assess the requirements to offset residual ecological impact (as well as impacts on the existing Biodiversity Offset Areas) and assess the value of potential areas available for offsetting purposes.

## 2.0 Methods

Due to the large amount of existing ecological data relating to the Mangoola Coal Project site, as well as the small size of the Proposed Modification Areas (totalling 11.7 hectares), the survey methodology adopted for this project focussed on the following:

- detailed literature review of previous ecological surveys completed for the Mangoola Coal Project to document all recorded (and potential) significant ecological features within the Proposed Modification Areas;
- analysis to identify any knowledge gaps in the existing literature, focussed specifically on the Proposed Modification Areas;
- completion of targeted field data to address these gaps, update existing knowledge for the Proposed Modification Areas and ground-truth existing data at a more refined scale; and
- targeting specific ecological features within the Proposed Modification Areas that require further attention and assessment.

When combined, the above methods provide a thorough and current understanding of the ecological features of the Proposed Modification Areas. The methods used as part of the current project built on the extensive amount of existing knowledge of the area, gained from the Ecological Assessment completed for the Anvil Hill Project EA (Umwelt 2006), as well as various ongoing post-approval projects, including seasonal monitoring of flora and fauna.

The methods used comprised a detailed literature review as well as searches of a variety of relevant ecological databases. Information gathered from this stage was then used to design a field survey program to ground-truth existing vegetation mapping, and to complete targeted surveys for threatened flora species, specific threatened fauna habitats, endangered populations, TECs, or their habitats, within the Proposed Modification Areas. Field surveys completed for the current project focussed on ground-truthing and (where required) updating existing ecological data for each of the Proposed Modification Areas.

### 2.1 Literature Review

The completion of the Anvil Hill Project EA (Umwelt 2006), as well as ongoing post-approval works has provided Umwelt with extensive knowledge of the ecological issues pertaining to the Proposed Modification Areas, and their surrounding environs. An in-depth literature review was undertaken for the Anvil Hill Project EA (Umwelt 2006), resulting in the collation of relevant information relating to significant ecological features of (or near) the Proposed Modification Areas. The ecological information gained from that literature review has been drawn upon for this Ecological Assessment and supplemented by relevant literature which has become available since that time.

#### 2.1.1 Ecological Database Searches

Searches of relevant ecological databases were also undertaken to identify threatened species, endangered populations and TECs recorded (or with potential to occur) within a 20 kilometre radius of the Proposed Modification Areas. This included a search of the Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife and the Department of Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Database. The results of these searches were compiled with the information gained

from the literature review to provide a list of potential significant ecological features to be considered as part of this Ecological Assessment.

### 2.1.2 Relevant Local Literature

A number of documents were reviewed for background information and ecological information to contribute to this Ecological Assessment. Attention was paid to recent documents that focus on the ecological features of the mine, and these are discussed further below.

#### 2.1.2.1 Anvil Hill Project Ecological Assessment (Umwelt 2006)

This document was prepared to support the project application for the (then) Anvil Hill mine. A detailed field survey program was completed over two years (covering all seasons), and covering a survey area of over 4000 hectares. The following significant ecological features (threatened or migratory species, populations and communities) were recorded:

- *Commersonia rosea*;
- *Diuris tricolor*;
- *Lasiopetalum longistamineum*;
- *Pomaderris queenslandica*;
- *Pomaderris reperta*;
- tiger orchid (*Cymbidium canaliculatum*) population;
- weeping myall (*Acacia pendula*) population;
- *Bothriochloa biloba*;
- Weeping Myall Woodland;
- glossy black-cockatoo (*Calyptorhynchus lathamii*);
- turquoise parrot (*Neophema pulchella*);
- powerful owl (*Ninox strenua*);
- masked owl (*Tyto novaehollandiae*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- speckled warbler (*Chthonicola sagittata*);
- hooded robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- diamond firetail (*Stagonopleura guttata*);
- koala (*Phascolarctos cinereus*);

- squirrel glider (*Petaurus norfolcensis*);
- brush-tailed rock-wallaby (*Petrogale penicillata*);
- eastern freetail-bat (*Mormopterus norfolkensis*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- large-footed myotis (*Myotis adversus*);
- greater broad-nosed bat (*Scoteanax rueppellii*);
- eastern cave bat (*Vespadelus troughtoni*);
- rainbow bee-eater (*Merops ornatus*);
- white-bellied sea-eagle (*Haliaeetus leucogaster*);
- white-throated needletail (*Hirundapus caudacutus*); and
- satin flycatcher (*Myiagra cyano-leuca*).

Since the completion of this assessment, four species that were recorded as part of the Anvil Hill EA have been listed as Vulnerable under the TSC Act. These are:

- little eagle (*Hieraaetus morphnoides*);
- varied sittella (*Daphoenositta chrysoptera*);
- little lorikeet (*Glossopsitta pusilla*); and
- scarlet robin (*Petroica boodang*).

Each of these has been considered within the current Ecological Assessment.

#### 2.1.2.2 Ecological Monitoring Reporting

Ecological monitoring at permanent monitoring points has been completed within the Mangoola Coal Project site, with its initial baseline monitoring covering spring, summer, autumn and winter of 2007-2008 (Umwelt 2009). This monitoring continued on a seasonal basis, and was reported on via seasonal briefing notes by Forest Fauna Surveys and Eastcoast Flora Survey (2008-2009), being for:

- Spring 2008;
- Summer 2008-2009;
- Autumn 2009;
- Winter 2009; and
- Spring 2009.

From the monitoring completed by Umwelt and Forest Fauna Surveys/Eastcoast Flora Survey, the following significant ecological features have been recorded:

- Weeping Myall Woodland;
- glossy black-cockatoo (*Calyptorhynchus lathamii*);
- brown treecreeper (eastern subspecies)(*Climacteris picumnus victoriae*);
- speckled warbler (*Chthonicola sagittata*);
- hooded robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- masked owl (*Tyto novaehollandiae*);
- squirrel glider (*Petaurus norfolcensis*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- large-footed myotis (*Myotis adversus*); and
- eastern cave bat (*Vespadelus troughtoni*).

Each of these has been considered within the current Ecological Assessment.

### 2.1.2.3 Targeted Orchid Surveys – Mangoola Mine

Targeted orchid surveys have also been completed for the Mangoola Coal Project (Eastcoast Flora Survey 2009a), as part of pre-clearing survey requirements within the approved project disturbance area. These surveys were completed during the appropriate flowering seasons to target:

- *Diuris tricolor*; and
- *Prasophyllum* sp. aff. *petilum* (undescribed) (now known as *Prasophyllum* sp. Wybong (C. Phelps ORG 5269).

In total, 35 specimens of *Diuris tricolor* and 47 of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) were detected in or adjacent to the target search areas, with an additional 34 and 12 specimens (respectively) recorded opportunistically elsewhere within the approved project disturbance area. None of the above records were recorded within the Proposed Modification Areas.

### 2.1.2.4 Targeted Orchid Surveys – Additional Biodiversity Offset Area

Targeted orchid surveys have also been completed within the additional biodiversity offset area (formerly known as the Nipol property) (Eastcoast Flora Survey 2009b) in order to investigate the status of significant orchid species in this property, as part of investigations into potential offset areas. These surveys were completed during the appropriate flowering seasons to target:

- *Diuris tricolor*;
- *Oligochaetochilus* sp. aff. *praetermissus* (Coonabarabran, undescribed); and
- *Prasophyllum* sp. aff. *petilum* (undescribed) (now known as *Prasophyllum* sp. Wybong (C. Phelps ORG 5269).

No individuals of the target orchids were recorded, despite confirmation that these species were flowering nearby in the Mangoola Coal Project site at the time of survey. The report concluded that the additional biodiversity offset area does not support extensive areas of suitable habitat for any of the target orchid species, as they were shown to favour derived native grassland within a narrow-leaved ironbark (*Eucalyptus crebra*) landscape. Only small areas of such habitat were recorded within the additional biodiversity offset area.

Despite the lack of significant terrestrial orchids present on the site, other significant features were recorded, being:

- Hunter Valley Footslopes Slaty Gum Woodland (Vulnerable Ecological Community);
- *Acacia homalophylla-pendula* (likely component of Endangered Population of *Acacia pendula* in the Hunter); and
- *Bothriochloa biloba*.

## 2.2 Flora Survey

The following sections document the methods employed for the flora surveys which were undertaken for the project on 30 September and 1 October 2009. Each of the Proposed Modification Areas was surveyed by two ecologists on foot, to identify potentially occurring threatened flora species, endangered populations and TECs, and significant habitat features for threatened fauna species.

The flora surveys focused on non-quantitative methods such as ground-truthing existing vegetation mapping (Umwelt 2006) and completing targeted threatened flora searches. Flora surveys were undertaken in accordance with the DECCW Draft Threatened Species Survey and Assessment Guidelines (DEC 2004), where appropriate.

The aims of the flora field surveys were to:

- ground-truth existing vegetation mapping for each Proposed Modification Area (Umwelt 2006), and modify where appropriate;
- describe the general health and condition of the vegetation of the Proposed Modification Areas;
- determine if any threatened flora species, endangered populations or TECs were present or have potential to occur within the Proposed Modification Areas; and
- gather sufficient information to enable an accurate assessment of the impacts of the project on the flora values of the Proposed Modification Areas.

### 2.2.1 Vegetation Transects

Walking vegetation transects were traversed throughout each of the Proposed Modification Areas (see **Figure 2.1**). The objectives of these transects were to:

- search for threatened flora species and endangered flora populations, including their habitats;
- assist in the ground-truthing of vegetation communities, including TECs;
- enable greater coverage of the Proposed Modification Areas than would be achieved by plot-based sampling; and
- contribute to floristic knowledge of the Proposed Modification Areas.

The meander transects were variable in length and location, and were tailored to suit the size and shape of each Proposed Modification Area, as well as the environment in which they occurred.

### 2.2.2 Plant Identification and Taxonomic Review

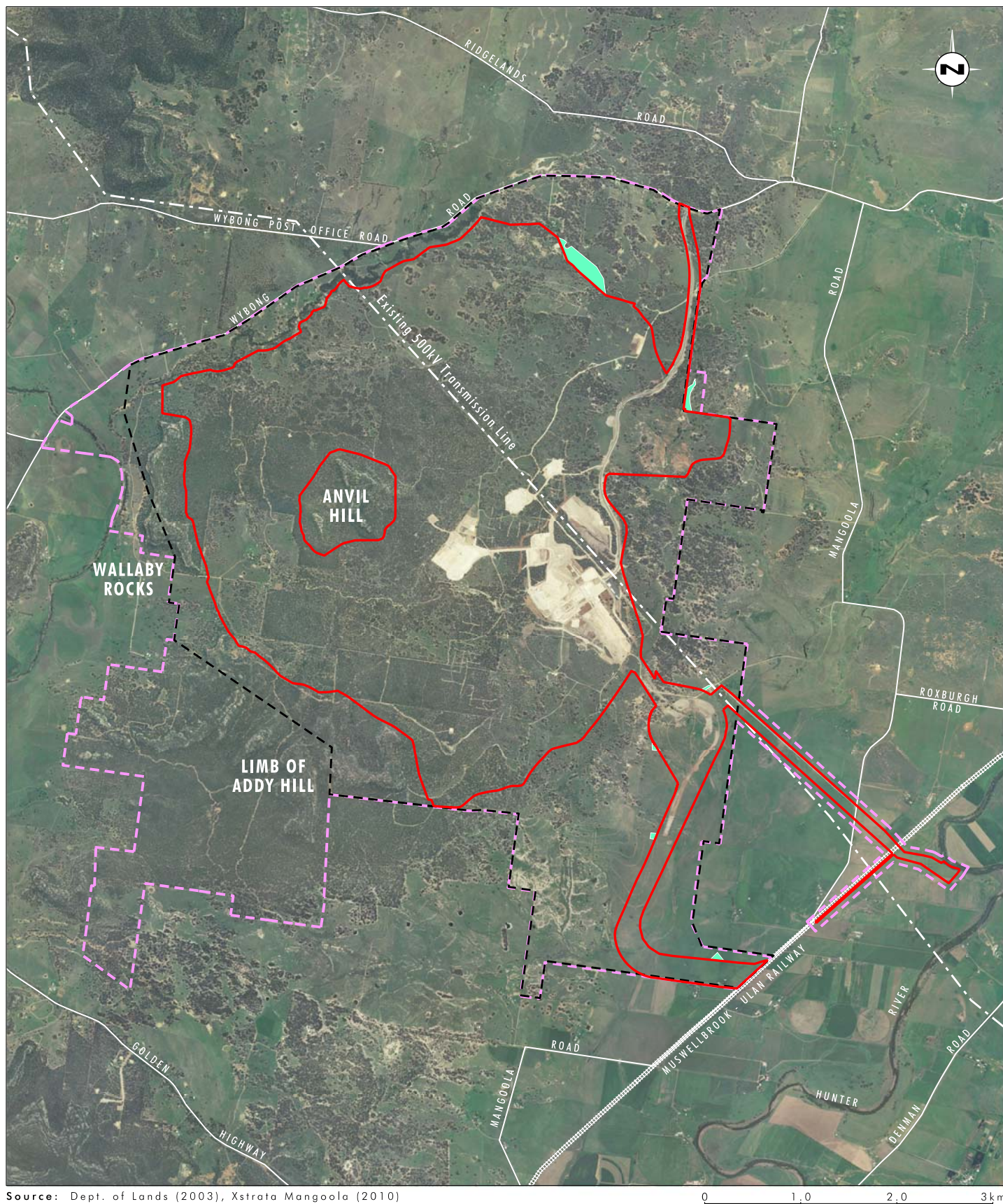
All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2010), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide common names. Where the identity of a specimen was unknown or uncertain, it was lodged with the National Herbarium of New South Wales at the Royal Botanic Gardens, Sydney.

## 2.3 Fauna Survey

As with the flora surveys, fauna surveys were concentrated within the Proposed Modification Areas only (**Figure 2.1**). Due to the small size of most of these areas, and the existing knowledge of the fauna assemblages gained from the Anvil Hill Project EA (Umwelt 2006), fauna surveys were restricted to opportunistic observations while completing flora surveys, as well as documentation of fauna habitat types and availability within each of the Proposed Modification Areas. The aims of the fauna field surveys were to:

- opportunistically record the fauna species present within the Proposed Modification Areas;
- identify and characterise the different habitat types present within each of the Proposed Modification Areas, and determine the likely fauna assemblage present (based on extensive field-based knowledge of the assemblages of the broader area);
- determine if any threatened fauna species or endangered fauna populations are present or have potential to occur within the Proposed Modification Areas; and
- accrue sufficient information to enable an accurate assessment of the impacts of the project on the fauna assemblages of the Proposed Modification Areas.



Source: Dept. of Lands (2003), Xstrata Mangoola (2010)

0 1.0 2.0 3 km

#### Legend

- Approved Project Disturbance Boundary
- Mining Lease 1626 Boundary
- Project Area
- Areas Subject to Ecological Survey

FIGURE 2.1

Ecological Survey Coverage of the  
Proposed Modification Areas

### 2.3.1 Opportunistic Fauna Surveys

Due to the small size and limited habitat values of the majority of the Proposed Modification Areas, fauna surveys were limited to opportunistic recordings of species encountered while completing flora and habitat surveys. Bird species were identified from characteristic calls and by observation, using 10 x 50 binoculars. Where encountered, likely micro-habitats were examined for herpetofauna, such as under rocks, logs, tree bark, ground litter and dams.

Searches for evidence of animal presence were conducted opportunistically during all survey activities. Evidence of presence included scats, feathers, nests, burrows, bones, tufts of hair and scratch marks on trees. All hair, scat and bone samples were identified by Barbara Triggs (a recognised expert in the field) of Dead Finish, Victoria.

### 2.3.2 Fauna Habitat Assessment

Habitat assessments were undertaken throughout each of the Proposed Modification Areas. These assessments targeted the identification of potential habitat features and resources for threatened fauna species. Observations of the following habitat features were made:

- tree size class (trunk diameter);
- hollow-bearing trees and stags;
- fallen timber/logs;
- ground cover of rock outcrops;
- presence and condition of wet areas and water bodies;
- type and density of shrub and groundcover; and
- presence of faunal refugia.

In addition to these general habitat features, searches for specific habitat requirements of threatened fauna species considered to potentially occur within the locality were also made, including the presence of winter-flowering eucalypt species, which are important foraging resources for migratory species such as the regent honeyeater (*Anthochaera phrygia*) and the swift parrot (*Lathamus discolor*).

Habitat features such as tree hollows and fallen logs were observed for any evidence of fauna occupation such as scratches on the trunks of trees, chewed entrances to hollows, scratchings or diggings near logs and scats.

Habitat features were considered when assessing the likely presence or absence of any threatened fauna species within the Proposed Modification Areas. The known habitat requirements of each potentially occurring threatened species were compared with the habitat features recorded within the Proposed Modification Areas.

### 2.3.3 State Environmental Planning Policy 44 - Koala Habitat Assessment

An application for project approval which relates to a site occurring within a Local Government Area (LGA) specified under State Environmental Planning Policy 44 (SEPP 44) – Koala Habitat Protection, affecting an area of 1 hectare or greater, must be assessed under SEPP 44. Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential koala (*Phascolarctos cinereus*) habitat. This is

determined by assessing whether the eucalypt species present in Schedule 2 of the policy constitute 15 per cent or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

The species listed in Schedule 2 of the policy are:

| Scientific Name                 | Common Name               |
|---------------------------------|---------------------------|
| <i>Eucalyptus tereticornis</i>  | forest red gum            |
| <i>Eucalyptus microcorys</i>    | tallowwood                |
| <i>Eucalyptus punctata</i>      | grey gum                  |
| <i>Eucalyptus viminalis</i>     | ribbon or manna gum       |
| <i>Eucalyptus camaldulensis</i> | river red gum             |
| <i>Eucalyptus haemastoma</i>    | broad-leaved scribbly gum |
| <i>Eucalyptus signata</i>       | scribbly gum              |
| <i>Eucalyptus albens</i>        | white box                 |
| <i>Eucalyptus populnea</i>      | bimble box or poplar box  |
| <i>Eucalyptus robusta</i>       | swamp mahogany            |

A SEPP 44 assessment was undertaken within each of the Proposed Modification Areas, whereby SEPP 44 listed canopy species were recorded, along with an estimate of the percentage of the total trees that comprise SEPP 44 species. Given the small size of the Proposed Modification Areas, an estimate of the percentage occurrence of SEPP 44 species was made over the extent of each of the Proposed Modification Areas.

## 3.0 Results

### 3.1 Flora

#### 3.1.1 Floristics

A considerable amount of quantitative field survey was completed as part of the Anvil Hill Project EA (Umwelt 2006). This survey resulted in the identification of a total of 597 flora species, comprising trees, tree mallees, shrubs, forbs, grasses, sedges, rushes, reeds, ferns, lithophytes, epiphytes, mistletoes, vines and twiners. Plants were recorded from all four major vascular plant classes: cycads, conifers, ferns and flowering plants. The flora species list from the Anvil Hill Project EA (Umwelt 2006) is included within **Appendix 1** of this report. While it is not assumed that all of these species occur within the Proposed Modification Areas, this list provides a detailed representation of the species recorded from the local area.

#### 3.1.2 Vegetation Communities

The Proposed Modification Areas have been previously addressed in the vegetation mapping prepared for the Anvil Hill Project EA (Umwelt 2006). The field surveys undertaken for the current project comprised ground-truthing of this existing vegetation mapping. The ground-truthing identified no need for revision to the existing vegetation mapping in these areas (**Figure 3.1**).

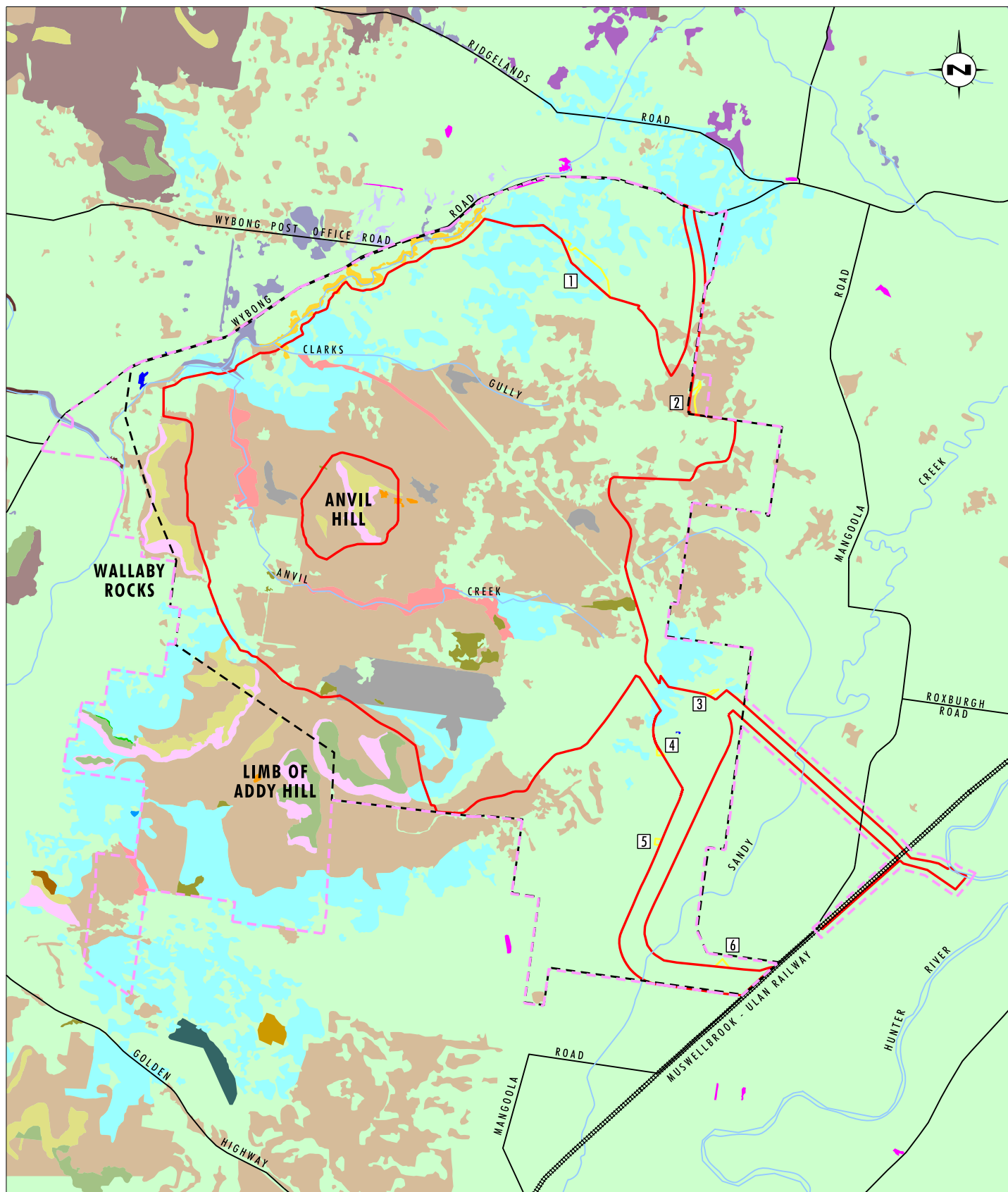
Three vegetation communities occur within the Proposed Modification Areas (**Figure 3.1**). Each of these communities is listed in **Table 3.1**, along with their conservation significance and their extent within each of the Proposed Modification Areas.

**Table 3.1 – Vegetation Communities within the Proposed Modification Areas**

| Vegetation Community      | Conservation Significance*                                                                                                                                                                                | Amount within Proposed Modification Area (ha)                                                                        |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Slaty Box Woodland        | Moderately widespread in the local area. Consistent with the Hunter Valley Footslopes Slaty Gum Woodland VEC, listed under the TSC Act.                                                                   | Proposed Modification Area 1 = 5.4                                                                                   |
| Ironbark Woodland Complex | Common and widespread in the local area and the central Hunter Valley. Moderate conservation significance. Consistent with the Central Hunter Grey Box – Ironbark Woodland EEC, listed under the TSC Act. | Proposed Modification Area 2 = 1.2                                                                                   |
| Disturbed Grassland       | Moderate abundance in the local area. Not a naturally occurring community but still of some conservation significance due to diversity of native species.                                                 | Proposed Modification Area 1 = 3.0<br>Proposed Modification Area 2 = 0.5<br>Proposed Modification Areas 3 to 6 = 1.6 |

\*Based on expert opinion, and drawing on Peake (2006) where equivalent vegetation communities exist.

As can be seen from **Table 3.1** and **Figure 3.1**, the Disturbed Grassland community is the most widespread community within the Proposed Modification Areas, comprising a total of 5.1 hectares. Approximately 1.2 hectares of the Ironbark Woodland Complex will be impacted, being entirely within Proposed Modification Area 2. The Slaty Box Woodland will



Source: Peake (2006)

0 1.0 2.0 3km

### Legend

- |                                                                                                                                       |                                                                                                                       |                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <span style="border: 2px solid red; padding: 2px;"> </span> Approved Project Disturbance Area                                         | <span style="background-color: #8B4513; border: 1px solid black; padding: 2px;"> </span> Vineyard                     | <span style="background-color: #2F4F4F; border: 1px solid black; padding: 2px;"> </span> Improved Pasture                                           |
| <span style="border: 2px dashed black; padding: 2px;"> </span> Mining Lease 1626 Boundary                                             | <span style="background-color: #800080; border: 1px solid black; padding: 2px;"> </span> Spotted Gum Open Forest      | <span style="background-color: #90EE90; border: 1px solid black; padding: 2px;"> </span> Disturbed/Modified Native Grassland                        |
| <span style="border: 2px dashed orange; padding: 2px;"> </span> Modified Project Disturbance Boundary                                 | <span style="background-color: #FFD700; border: 1px solid black; padding: 2px;"> </span> Swamp Oak Riparian Forest    | <span style="background-color: #008000; border: 1px solid black; padding: 2px;"> </span> Red Ash Sheltered Forest                                   |
| <span style="border: 2px dashed magenta; padding: 2px;"> </span> Project Area                                                         | <span style="background-color: #6B8E23; border: 1px solid black; padding: 2px;"> </span> Paperbark Woodland           | <span style="background-color: #00BFFF; border: 1px solid black; padding: 2px;"> </span> Cypress Pine Woodland                                      |
| <span style="background-color: #A0522D; border: 1px solid black; padding: 2px;"> </span> Ironbark-Wattle Low Exposed Woodland Complex | <span style="background-color: #FF8C00; border: 1px solid black; padding: 2px;"> </span> Tall Mixed Shrubland Complex | <span style="background-color: #ADD8E6; border: 1px solid black; padding: 2px;"> </span> Slaty Box Woodland (VEC, TSC Act)                          |
| <span style="background-color: #FF4500; border: 1px solid black; padding: 2px;"> </span> Forest Red Gum Riparian Woodland             | <span style="background-color: #8B4513; border: 1px solid black; padding: 2px;"> </span> Drooping Sheoak Woodland     | <span style="background-color: #D2B48C; border: 1px solid black; padding: 2px;"> </span> Ironbark Woodland Complex (EEC, TSC Act)                   |
| <span style="background-color: #FF00FF; border: 1px solid black; padding: 2px;"> </span> Mixed Species Revegetation/Plantation        | <span style="background-color: #8B4513; border: 1px solid black; padding: 2px;"> </span> River Oak Riparian Forest    | <span style="background-color: #0000FF; border: 1px solid black; padding: 2px;"> </span> Weeping Myall Woodland (EEC, TSC and EPBC Acts)            |
| <span style="background-color: #FFB6C1; border: 1px solid black; padding: 2px;"> </span> Sheltered Grey Gum Woodland                  | <span style="background-color: #B0C4DE; border: 1px solid black; padding: 2px;"> </span> Exotic Rushland              | <span style="background-color: #6A5ACD; border: 1px solid black; padding: 2px;"> </span> Rough-barked Apple Woodland (consistent with EEC, TSC Act) |
| <span style="background-color: #FFD700; border: 1px solid black; padding: 2px;"> </span> Coast Myall Exposed Woodland                 | <span style="background-color: #A9A9A9; border: 1px solid black; padding: 2px;"> </span> Bullock Woodland             |                                                                                                                                                     |

File Name (A4): R15\_V1/2497\_277.dgn

**FIGURE 3.1**  
**Vegetation Communities**

be impacted over 5.4 hectares, entirely within Proposed Modification Area 1. One of these communities is consistent with a TSC Act-listed EEC and one is consistent with a TSC Act-listed vulnerable ecological community (VEC).

### 3.1.2.1 Slaty Box Woodland

Slaty Box Woodland occurs entirely within Proposed Modification Area 1 (**Figure 3.1**). This community is characterised by the predominance of slaty box (*Eucalyptus dawsonii*), forming a woodland canopy of about 12-20 metres in height and 10-40 per cent cover.

Some or all of the following shrubs form a sparse low mid-stratum of up to 3 metres in height: bulloak (*Allocasuarina luehmannii*), native olive (*Notelaea microcarpa* var. *microcarpa*), shiny-leaved canthium (*Psydrax odorata*), coobah (*Acacia salicina*) and hickory wattle (*Acacia implexa*).

The groundcover is typically sparse at only 30 per cent cover, with a height of typically less than 0.4 metre. Often, large expanses of bare soil or leaf and bark litter are present, with only sparse clumps of groundcover plants. Common species include speargrass (*Austrostipa scabra* var. *scabra*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), kidney weed (*Dichondra repens*), many-flowered mat-rush (*Lomandra multiflora* subsp. *multiflora*), three-awn wiregrass (*Aristida vagans*), blue trumpet (*Brunoniella australis*), common everlasting (*Chrysocephalum apiculatum*), and winter apple (*Eremophila debilis*). The introduced species tiger pear (*Opuntia aurantiaca*) was also recorded.

The NSW Scientific Committee made a final determination to list the Hunter Valley Footslopes Slaty Gum Woodland (which is consistent with the Slaty Box Woodland of the Proposed Modification Areas) on 12 February 2010 as a VEC under the TSC Act.

### 3.1.2.2 Ironbark Woodland Complex

This community occurs entirely within Proposed Modification Area 2 (**Figure 3.1**), with narrow-leaved ironbark (*Eucalyptus crebra*) typically forming a canopy that has 30 per cent cover and ranges between 10 and 25 metres in height. Other canopy species occurring sporadically include grey box (*Eucalyptus moluccana*), Blakelys red gum (*Eucalyptus blakelyi*) and rough-barked apple (*Angophora floribunda*).

A moderately sparse mid-stratum up to 3 metres in height is present, with commonly occurring species being sticky daisy bush (*Olearia elliptica*), native olive (*Notelaea microcarpa* var. *microcarpa*), sticky hop bush (*Dodonaea viscosa*) and *Pultenaea cinerascens*.

The moderately dense groundcover is less than 0.5 metre in height, and comprises a large variety of forbs, many grasses, and a small number of sedges, ferns and twiners. The more abundant species include speargrass (*Austrostipa scabra* subsp. *scabra*), three-awn wiregrass (*Aristida vagans*), kidney weed (*Dichondra repens*), wallaby grass (*Austrodanthonia fulva*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), slender rats tail grass (*Sporobolus creber*), yellow burr-daisy (*Calotis lappulacea*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*) and common everlasting (*Chrysocephalum apiculatum*).

The NSW Scientific Committee made a final determination to list the Central Hunter Grey Box – Ironbark Woodland (which is broadly consistent with the Ironbark Woodland Complex of the Proposed Modification Areas) on 12 February 2010 as an EEC under the TSC Act.

### 3.1.2.3 Disturbed Grassland

Disturbed Grassland is the only vegetation community mapped within Proposed Modification Areas 3 to 6, and also occurs within parts of Proposed Modification Areas 1 and 2. This is a widespread vegetation community that occurs as a result of extensive human modification of the natural woodland and open forest environments in the general locality. The structure and floristic composition of the community throughout the Proposed Modification Areas is variable, being largely dependent on previous and current land use. In general, it is an open to closed grassland of 0.1-1 metre in height, dominated by a diverse range of native and introduced grasses and forbs, with fewer sedges and ferns.

The following species include the most frequent natives that are encountered: three-awned wiregrass (*Aristida vagans*), wiregrass (*Aristida ramosa*), wallaby grass (*Austrodanthonia fulva*), couch (*Cynodon dactylon*), speargrass (*Austrostipa scabra* subsp. *scabra*), slender rats tail grass (*Sporobolus creber*), fairy grass (*Sporobolus caroli*), common everlasting (*Chrysocephalum apiculatum*), kidney weed (*Dichondra repens*), common bog rush (*Schoenus apogon*), winter amulla (*Eremophila debilis*), climbing saltbush (*Einadia nutans* subsp. *nutans*), twining glycine (*Glycine clandestina*) and variable glycine (*Glycine tabacina*).

The following species include the most frequent introduced plants that are encountered: fireweed (*Senecio madagascariensis*), scarlet pimpernel (*Anagallis arvensis*), slender plantain (*Plantago lanceolata*), Paddys lucerne (*Sida rhombifolia*), French flax (*Linum trigynum*), soft brome (*Bromus molliformis*) and prickly pear (*Opuntia stricta* var. *stricta*).

Remnant trees were not present in the Disturbed Grassland of the Proposed Modification Areas 3 to 6, however were present in varying densities in Proposed Modification Areas 1 and 2.

While the presence of this vegetation community has resulted from the clearing of forests and woodlands, it still has reasonable conservation value for native flora and fauna. Rare or threatened plants such as tricolour diuris (*Diuris tricolor*) and lobed blue grass (*Bothriochloa biloba*) can still be present where suitable conditions exist. Despite this, the vegetation community is not, in itself, of high conservation significance. The threatened tricolour diuris (*Diuris tricolor*) was recorded in the Disturbed Grassland within Proposed Modification Area 1, as part of the current project. While not recorded at the time of survey for this project, there is potential that lobed blue grass (*Bothriochloa biloba*) could occur within the Disturbed Grassland habitats of the Proposed Modification Areas.

## 3.2 Fauna

A total of 30 fauna species were identified during opportunistic surveys undertaken for this project; a summary of those recorded is provided below. A list of these fauna species recorded from surveys of the Proposed Modification Areas is provided in Table 1 of **Appendix B**.

### 3.2.1 Fauna Species

#### 3.2.1.1 Birds

Twenty-four bird species were identified within the Proposed Modification Areas during opportunistic fauna surveys. No threatened species were recorded, however seven species listed as marine or migratory under the EPBC Act were recorded.

Some of the most commonly identified bird species in the Proposed Modification Areas were the superb fairy wren (*Malurus cyaneus*), Australian magpie (*Gymnorhina tibicen*) and noisy miner (*Manorina melanocephala*).

One introduced bird species was also identified in the Proposed Modification Areas, being the common starling (*Sturnus vulgaris*).

### 3.2.1.2 Reptiles

No reptiles were recorded during opportunistic surveys of the Proposed Modification Areas.

### 3.2.1.3 Amphibians

No amphibians were recorded during opportunistic surveys of the Proposed Modification Areas.

### 3.2.1.4 Mammals

Six mammal species were recorded within the Proposed Modification Areas during the opportunistic fauna surveys. These species included the eastern grey kangaroo (*Macropus giganteus*), swamp wallaby (*Wallabia bicolor*) and common wombat (*Vombatus ursinus*). The remaining species were introduced, and comprise the fox (*Vulpes vulpes*), cattle (*Bos taurus*) and rabbit (*Oryctolagus cuniculus*).

No threatened mammal species were recorded during opportunistic surveys of the Proposed Modification Areas.

## 3.2.2 Terrestrial Fauna Habitats

Two broad terrestrial fauna habitat types were recorded from the Proposed Modification Areas, these being Woodland and Grassland. The Proposed Modification Areas cover 11.7 hectares, 6.6 hectares of which (56 per cent) comprises Woodland habitat and 5.1 hectares (44 per cent) comprising Grassland. The Woodland habitats provide the highest diversity of habitat niches for fauna species. Both habitat formations are widespread within the locality.

The Woodland habitat provides a variety of habitat resources for fauna species. In particular, the blossoming *Eucalyptus* spp. provide foraging resources for nectarivorous and insectivorous species. This would include threatened mammals such as the squirrel glider (*Petaurus norfolcensis*), and a wide diversity of micro-bat species known to occur in the area. The understorey stratum in the Woodland is generally sparse (particularly within the Slaty Box Woodland) and therefore provides limited cover for ground and mid-storey dwelling fauna species. However, there is a moderate density of log and rock cover in some remnants, which would provide cover for small reptiles and amphibians. There was no aquatic habitat present within the Proposed Modification Areas, reducing potential for amphibian species.

The Grassland habitat provides a greatly reduced variety of habitat niches for fauna species. No remnant trees were present within this habitat type in Proposed Modification Areas 3 to 6, however they were present in Proposed Modification Areas 1 and 2. Very low levels of terrestrial cover (in the form of logs, boulders and shrubby vegetation) were present. Due to the distance between the habitats of Proposed Modification Areas 3 to 6 and stands of remnant vegetation, it is not likely that edge-foraging fauna species (such as robins) would utilise these habitats to a great degree.

Hollow-bearing trees are a valuable fauna habitat resource within the Woodland habitat type, and there are many hollow-dependent fauna species recorded within the Anvil Hill Project EA (Umwelt 2006), with potential to utilise the hollow resources in the Woodland habitats. During the fauna field survey, approximately 20 hollow-bearing trees were recorded, coming only from the Woodland habitats of Proposed Modification Areas 1 and 2. No hollow-bearing trees were recorded from the other Proposed Modification Areas.

### 3.3 Threatened Species, Endangered Populations and Threatened Ecological Communities

The following sections discuss legislatively protected threatened species, endangered populations and TECs that relate to the Proposed Modification Areas.

#### 3.3.1 Threatened Flora Species

Table 1 of **Appendix C** lists threatened flora species recorded from ecological database searches within a 20 kilometre radius of the Proposed Modification Areas, records from the Anvil Hill Project EA (Umwelt 2006) and other relevant literature sources, and records from expert knowledge of the local area.

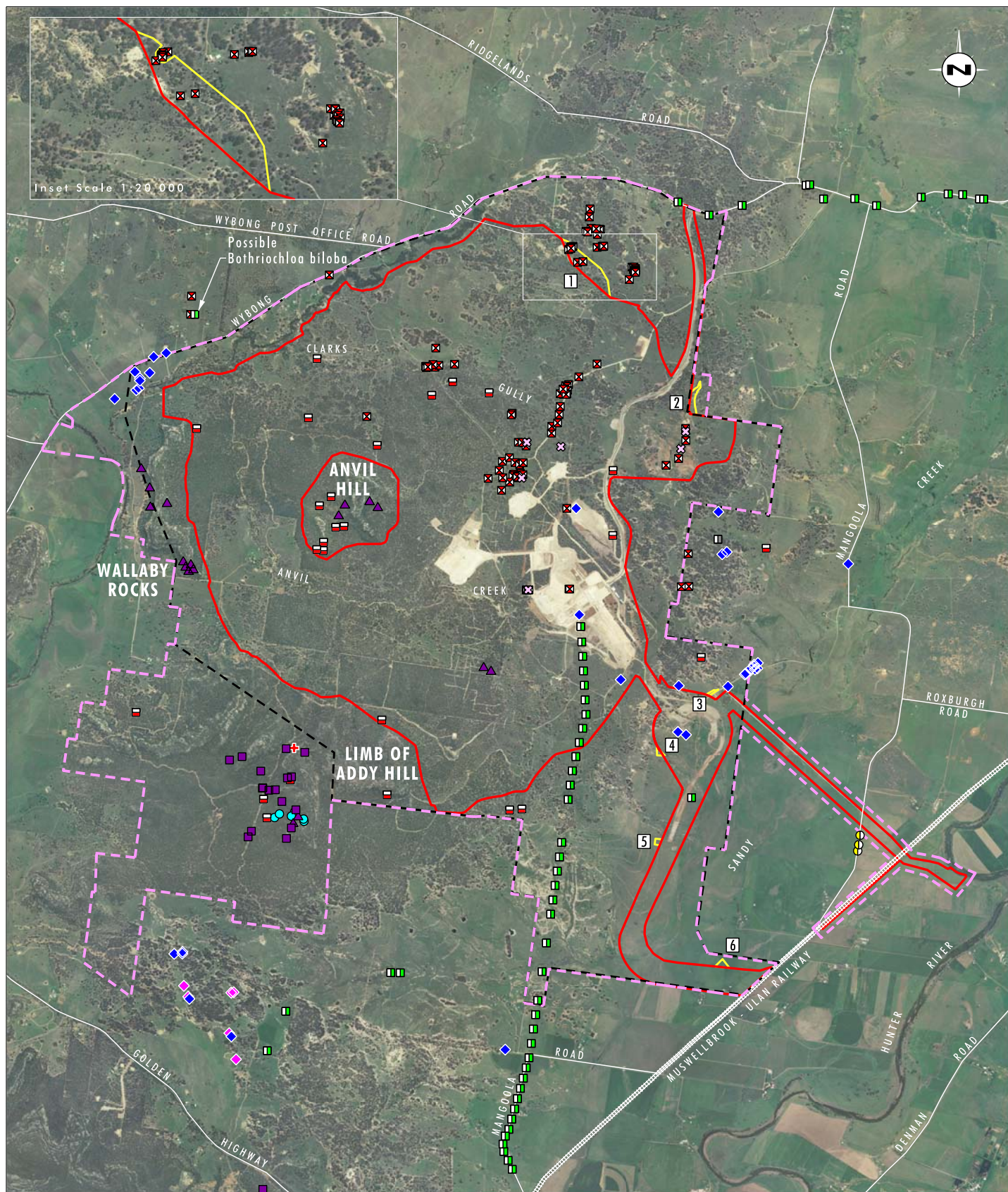
*Prasophyllum* sp. Wybong (C. Phelps ORG 5269) has the potential to occur within the habitats of the Proposed Modification Areas. This species has been recorded from the approved project disturbance area only within the Mangoola Coal Project site (see **Figure 3.2**). This species was recorded in similar habitats to tricolour diuris (*Diuris tricolor*) within the approved project disturbance area, however has not been recorded within the Proposed Modification Areas, as part of the current survey.

One threatened flora species was recorded in the Proposed Modification Areas, being tricolour diuris (*Diuris tricolor*). More detail on the records of this species is provided below.

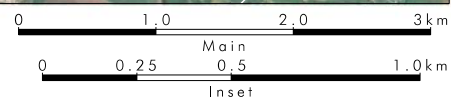
##### 3.3.1.1 Tricolour diuris (*Diuris tricolor*)

Tricolour diuris (*Diuris tricolor*) is listed as vulnerable under the TSC Act. Those records occurring in the Muswellbrook LGA (in which the Proposed Modification Areas occur) also comprise the TSC Act listed endangered population of this species (see **Section 3.3.3**).

This species was recorded on three occasions from Proposed Modification Area 1 (**Figure 3.2**). On each of these occasions, these records involved single specimens. No records of this species were obtained from any of the other Proposed Modification Areas. There are a relatively large number of additional records of this species from the approved project disturbance area for the Mangoola Coal Project, the Biodiversity Offset Areas, the Assessment Areas for the proposed relocation of the 500 kV transmission line, as well as within the local Wybong area. These records would total several hundreds of individuals of this species. While there are only three known records of this species within Proposed Modification Area 1, numerous other records were identified in the vicinity of this Proposed Modification Area. In response to the identification of these records during field survey, the original boundary of this Proposed Modification Area was reduced to exclude all but three of these records (**Figure 3.2**), thereby reducing the potential impact on this species. **Sections 1.2** and **5.1.1.1** of this report discuss this issue further. The grassland habitats and some of the marginal grassy woodland habitats within the other Proposed Modification Areas provide potential habitat for this species.



Source: DECC Atlas of NSW Wildlife (2006), National Herbarium of NSW (2006),  
HLA Envirosciences (2003)  
Base Source: Dept. of Lands (2003), Xstrata Mangoola (2010)



### Legend

- |                                                                                                      |                                                                                            |                                                                        |
|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| <span style="border: 2px solid red; padding: 2px;"> </span> Approved Project Disturbance Area        | <span style="border: 1px solid red; padding: 2px;"> </span> <i>Cymbidium canaliculatum</i> | <span style="color: pink;">◆</span> <i>Acacia homalophylla-pendula</i> |
| <span style="border: 1px dashed black; padding: 2px;"> </span> Mining Lease 1626 Boundary            | <span style="color: red;">✕</span> <i>Diuris tricolor</i>                                  | <span style="color: green;">✕</span> <i>Prasophyllum</i> sp. Wyalong   |
| <span style="border: 1px solid yellow; padding: 2px;"> </span> Modified Project Disturbance Boundary | <span style="color: yellow;">●</span> <i>Eucalyptus camaldulensis</i>                      |                                                                        |
| <span style="border: 1px solid pink; padding: 2px;"> </span> Project Area                            | <span style="color: blue;">●</span> <i>Lasiopetalum longistamineum</i>                     |                                                                        |
| <span style="color: blue;">◆</span> <i>Acacia pendula</i>                                            | <span style="color: purple;">▲</span> <i>Pomaderris queenslandica</i>                      |                                                                        |
| <span style="color: green;">■</span> <i>Bothriochloa biloba</i>                                      | <span style="color: purple;">■</span> <i>Pomaderris reperta</i>                            |                                                                        |
| <span style="color: red;">✕</span> <i>Commersonia rosea</i>                                          | <span style="color: black;">■</span> <i>Thesium australe</i>                               |                                                                        |

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FIGURE 3.2

Threatened Flora Locations

### 3.3.2 Threatened Ecological Communities

A review of the relevant literature and schedules of the TSC Act and EPBC Act was undertaken to determine if any TECs could potentially occur within the Proposed Modification Areas. These are listed in Table 2 of **Appendix C**. The floristic, structural and physiographic characteristics of each of the vegetation communities present within the Proposed Modification Areas were considered for their potential to include any of these TECs.

One EEC and one VEC occur within the Proposed Modification Areas. Further discussion of each of these is provided in the following sections. One other TEC, the Weeping Myall Woodland EEC, was found to occur approximately 50 metres to the east of Proposed Modification Area 3 (**Figure 3.2**). This EEC will not be impacted by the project.

#### 3.3.2.1 Central Hunter Grey Box – Ironbark Woodland

The Ironbark Woodland Complex recorded from Proposed Modification Area 2 (covering 1.2 hectares) is consistent with the Central Hunter Grey Box – Ironbark Forest EEC (NSW Scientific Committee 2010a). In relation to the proposed modification areas, this community has been recorded from Proposed Modification Area 2 only, and in this location it is dominated by narrow-leaved ironbark (*Eucalyptus crebra*) and, to a lesser extent, grey box (*Eucalyptus moluccana*), both of which are characteristic species of the EEC. The understorey structure and composition of both the Ironbark Woodland Complex and the EEC also show strong similarities.

#### 3.3.2.2 Hunter Valley Footslopes Slaty Gum Woodland

The Slaty Box Woodland recorded from Proposed Modification Area 1 (covering 5.4 hectares) is consistent with the listed Hunter Valley Footslopes Slaty Gum Woodland VEC. The communities show strong correlations in both floristic and structural composition, as well as geomorphological characteristics.

This community has been listed under the Vulnerable category, as its geographic distribution is estimated or inferred to be moderately restricted, and the nature of its distribution makes it likely that the action of a threatening process could cause it to decline or degrade in extent or ecological function over a time span appropriate to the life cycle and habitat characteristics of the ecological community's component species (NSW Scientific Committee 2010b).

Despite this recent listing, this community is not required to be given any increased consideration in the impact assessment under the EP&A Act. This is because the EP&A Act requires the detailed assessment of critically endangered and endangered ecological communities, but not vulnerable ecological communities. The impact on this community has, however, been assessed as part of the general impact assessment and considered in the development of an offset strategy for the project, due to the provision of habitat for threatened species in this community.

### 3.3.3 Endangered Populations

Table 3 of **Appendix C** lists the endangered populations which have potential to occur within the Proposed Modification Areas. There are three endangered populations which were recorded in the vicinity of the Proposed Modification Areas (Umwelt 2006), being the populations of:

- weeping myall (*Acacia pendula*) in the Hunter Catchment;
- tricolour diuris (*Diuris tricolor*) in the Muswellbrook LGA; and
- tiger orchid (*Cymbidium canaliculatum*) in the Hunter Catchment.

One stand of weeping myall (*Acacia pendula*) occurs to the immediate east of Proposed Modification Area 3 (**Figure 3.2**), extending along the unformed verges of Coolibah Road. This stand of *Acacia pendula* comprises the endangered population and the listed EEC. This stand will not be disturbed as a result of the project.

Three individuals of tricolour diuris (*Diuris tricolor*) were recorded in Proposed Modification Area 1. **Section 3.3.1** (above) provides further discussion on this species and the locations of these records are provided on **Figure 3.2**.

**Figure 3.2** shows the known sites where *Cymbidium canaliculatum* has been previously recorded as part of the Anvil Hill Project EA (Umwelt 2006) and as part of the inter-related 500 kV electricity transmission line relocation project. There are no records of this species within the Proposed Modification Areas, however there is potential (albeit low) for it to occur in the treed areas.

### 3.3.4 Threatened Fauna Species

Table 4 of **Appendix C** lists threatened fauna species recorded from ecological database searches within a 20 kilometre radius of the Proposed Modification Areas, records from the Anvil Hill Project EA (Umwelt 2006), other relevant literature and records added from expert knowledge of the local area. From this list, a number of threatened fauna species were found to have potential to occur within the Proposed Modification Areas. **Figure 3.3** shows the locations of those threatened fauna species recorded within the Proposed Modification Areas during current surveys and wider locality as part of other local surveys.

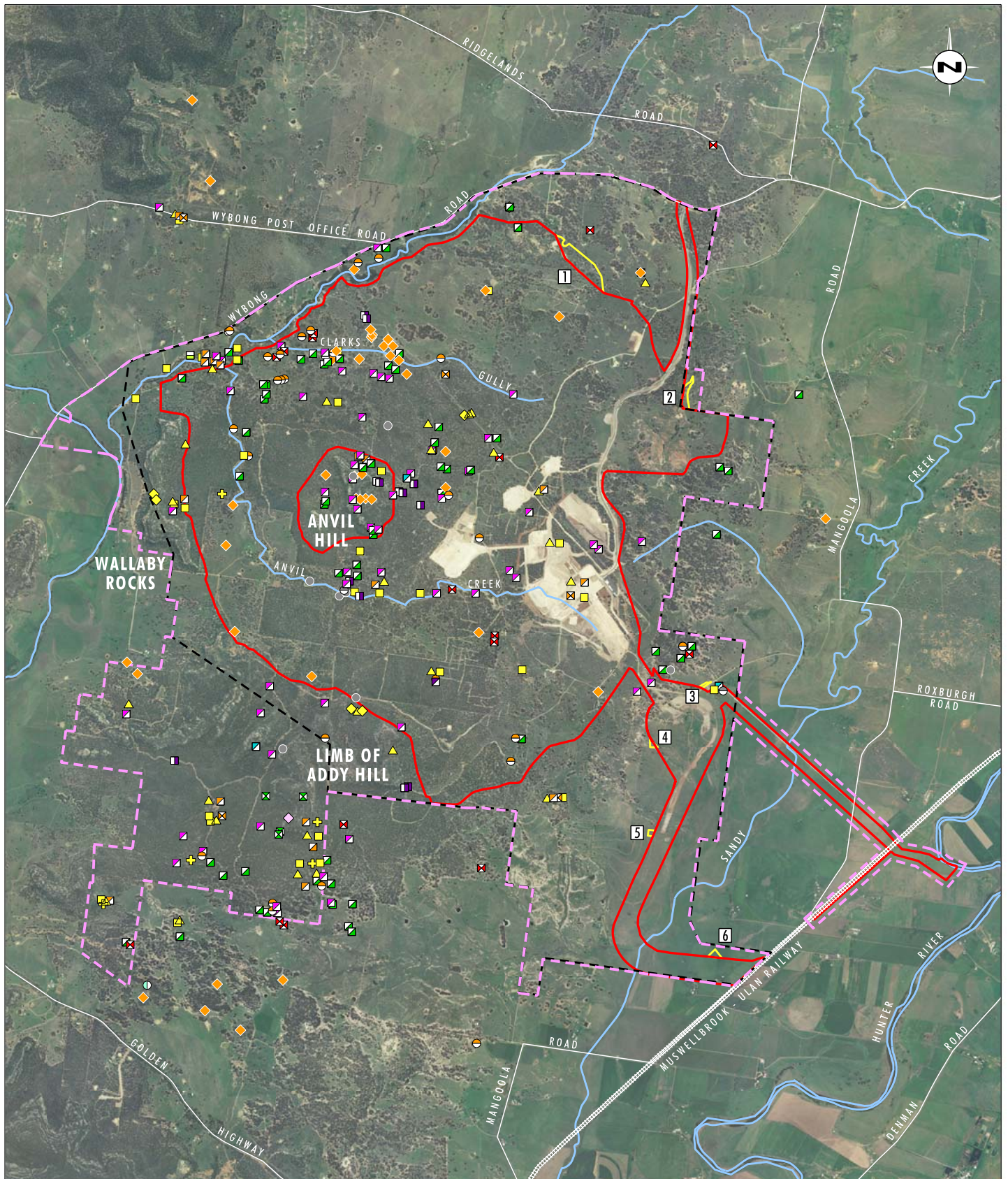
No threatened fauna species were recorded during opportunistic surveys of the Proposed Modification Areas. There is the potential for a number of threatened fauna species to occur within the Woodland habitats of Proposed Modification Areas 1 and 2. It is likely that threatened bird and micro-bat species would utilise the Woodland habitat niches. Threatened species such as the grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) and the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) could reasonably be expected to utilise such habitats.

It is unlikely that the Grassland habitats of the remaining Proposed Modification Areas would support threatened fauna species.

There are a number of other threatened fauna species that were found to have potential to occur within the Proposed Modification Areas based on known distribution and habitat requirements, many of which were recorded for the Anvil Hill Project EA (Umwelt 2006). Potentially occurring threatened fauna species are indicated in Table 4 of **Appendix C**.

### 3.3.5 EPBC Act Listed Migratory Species

A search of the DEWHA Protected Matters Database was undertaken in order to identify EPBC Act listed threatened, migratory or listed marine species which could potentially occur within a 20 kilometre radius of the Proposed Modification Areas (based on DEWHA habitat modelling). Table 5 of **Appendix C** lists those species from the database search, as well as records added from the literature review and professional opinion of potential to occur.



Source: Birds Australia (2006), DECC Atlas of NSW Wildlife (2006), HCRMA (1999),

HLA Envirosciences (2003), Australian Museum (2006)

Base Source: Dept. of Lands (2003), Xstrata Mangoola (2010)

#### Legend

- |                                                                                                                  |                                                                                                                   |                                                                                                              |                                                                                                      |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <span style="border: 2px solid red; padding: 2px;"> </span> Approved Project Disturbance Area                    | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Eastern Cave Bat          | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Large-eared Pied Bat | <span style="background-color: green; border: 1px solid black; padding: 2px;"> </span> Scarlet Robin |
| <span style="border: 2px dashed black; padding: 2px;"> </span> Mining Lease 1626 Boundary                        | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Eastern False Pipistrelle | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Large-footed Myotis  |                                                                                                      |
| <span style="border: 2px dashed yellow; padding: 2px;"> </span> Modified Project Disturbance Boundary            | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Eastern Freetail-bat      | <span style="background-color: blue; border: 1px solid black; padding: 2px;"> </span> Masked Owl             |                                                                                                      |
| <span style="border: 2px dashed pink; padding: 2px;"> </span> Project Area                                       | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Glossy Black-Cockatoo     | <span style="background-color: blue; border: 1px solid black; padding: 2px;"> </span> Powerful Owl           |                                                                                                      |
| <span style="background-color: green; border: 1px solid black; padding: 2px;"> </span> Brown Treecreeper         | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Greater Broad-nosed Bat   | <span style="background-color: pink; border: 1px solid black; padding: 2px;"> </span> Speckled Warbler       |                                                                                                      |
| <span style="background-color: green; border: 1px solid black; padding: 2px;"> </span> Brush-tailed Rock-wallaby | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Grey-crowned Babbler      | <span style="background-color: grey; border: 1px solid black; padding: 2px;"> </span> Squirrel Glider        |                                                                                                      |
| <span style="background-color: red; border: 1px solid black; padding: 2px;"> </span> Diamond Firetail            | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Hooded Robin              | <span style="background-color: grey; border: 1px solid black; padding: 2px;"> </span> Turquoise Parrot       |                                                                                                      |
| <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Eastern Bentwing-bat     | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Koala                     | <span style="background-color: green; border: 1px solid black; padding: 2px;"> </span> Little Lorikeet       |                                                                                                      |

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**FIGURE 3.3**  
**Threatened  
Fauna Locations**

Of these, seven marine/migratory species were recorded, being the Australian wood duck (*Chenonetta jubata*), Pacific black duck (*Anas superciliosa*), Australian white ibis (*Threskiornis molucca*), wedge-tailed eagle (*Aquila audax*), Australian kestrel (*Falco cenchroides*), magpie-lark (*Grallina cyanoleuca*) and welcome swallow (*Hirundo neoxena*).

### 3.3.6 SEPP 44 (Koala Habitat) Assessment Results

No SEPP 44 listed koala feed trees were recorded within the Proposed Modification Areas, and no individual koalas (*Phascolarctos cinereus*), or secondary evidence such as scats or tree scratches, were observed during surveys of these areas. There are, however, records of koala scats from the Anvil Hill Project EA (Umwelt 2006) to the south-west of the Proposed Modification Areas near Limb of Addy the (**Figure 3.3**). There is no further evidence to suggest that there is a resident population of koalas (*Phascolarctos cinereus*) in the local area, despite ongoing fauna surveys in the Mangoola Coal Project area.

## 4.0 Impact Assessment

A number of threatened flora and fauna species, populations and TECs were recorded or have potential to occur within the Proposed Modification Areas, and may be impacted by the removal of vegetation (and associated habitat) from these areas. The following impact assessment addresses those direct and indirect impacts that may result on significant ecological features of the Proposed Modification Areas. Direct impacts, in this case, relate to the removal of vegetation and habitat for construction purposes. Indirect impacts include issues such as fragmentation, potential increases in edge effects, as well as potential weed invasion and increased exposure to predators. The impact of the loss of parts of the approved Biodiversity Offset Areas has also been considered as part of this assessment.

### 4.1 Direct Impacts

The project involves the removal of all vegetation and habitat features within each of the Proposed Modification Areas, resulting in disturbance to 11.7 hectares. There is expected to be no disturbance outside of these areas, as a result of this project. Any removal of vegetation (including scattered trees and woody vegetation within grasslands) will be required to follow all clearing-related procedures established for the construction phase and documented in the Draft Rehabilitation and Offset Management Plan (ROMP) (Umwelt, in prep.).

### 4.2 Indirect Impacts

The removal of all vegetation and associated habitats within the Proposed Modification Areas is not likely to cause a substantial increase in indirect impacts such as edge effects, weed invasion or increased predation. This is a result of the Proposed Modification Areas being located on the edge of areas already approved for disturbance, and as such already exposed to such potential indirect impacts. The small area proposed to be added to the approved project disturbance area is not of a size that will greatly increase these potential impacts.

### 4.3 Impacts on Flora Species

A total of 11.7 hectares of vegetation will be impacted as a result of the Proposed Modification Areas. This vegetation has been mapped as comprising community types that are well represented in the approved Biodiversity Offset Areas, as well as in the broader local area. These communities comprise a range of native and introduced flora species that are representative of those occurring in the broader landscape. The project is not likely to result in a loss of flora species that form these communities such that the biodiversity value of the area will be reduced. As discussed in **Section 4.6**, Modification Area 1 has been modified to substantially reduce the impact on the *Diuris tricolor* population identified in this area.

## 4.4 Impacts on Vegetation Communities

The following three vegetation communities have been recorded within the Proposed Modification Areas:

- Ironbark Woodland Complex (1.2 hectares);
- Slaty Box Woodland (5.4 hectares); and
- Disturbed Grassland (5.1 hectares).

Of the 11.7 hectares of vegetation to be removed as part of the Proposed Modification Areas, 44 per cent comprises the Disturbed Grassland, where substantial clearing and existing disturbances have already reduced the biodiversity value of this community. The remaining 56 per cent of vegetation to be removed comprises two communities of higher quality woodland vegetation, each of which has legislative significance.

Given the general lack of canopy and understorey strata, the Disturbed Grassland community is unlikely to be substantially disturbed by the project. While this community is known to contain habitat for a number of threatened species (such as tricolour diuris, *Diuris tricolor*), it is not likely to be of high conservation significance in its own right. The project is not likely to result in a significant reduction in the amount or quality of Disturbed Grassland in a local or regional context.

Approximately 1.2 hectares of Ironbark Woodland Complex and 5.4 hectares of Slaty Box Woodland will be removed as a result of the proposed modification. Both of these communities are of conservation significance, as they are both consistent with listed TECs. These are discussed further in **Section 4.8**.

## 4.5 Impacts on Fauna Species and Habitats

The fauna habitat values of the Proposed Modification Areas are relatively limited, as a result of the highly modified and fragmented nature of much of the vegetation that occurs in these areas. Despite this, the Proposed Modification Areas do support foraging and nesting resources for a range of fauna species, particularly within natural woodland remnants where they adjoin open grassland areas.

The proposed modification will result in disturbance to approximately 6.6 hectares of woodland habitat and 5.1 hectares of grassland, the latter being a highly modified community. Both the grassland and the woodland habitats have potential to be utilised by a number of fauna species including threatened fauna, however the grassland within the Proposed Modification Areas provides a much lower diversity of habitat niches. While there is potential habitat for a range of fauna species, it is not expected that the Proposed Modification Areas support habitats that would be essential to the survival of any fauna species within the local area. Fauna species utilising the habitats of the Proposed Modification Areas would be doing so as part of a wider habitat range, and would not rely specifically or solely on the habitats of the Proposed Modification Areas for survival.

The project is likely to require the removal of hollow-bearing trees where they occur within the Proposed Modification Areas. Approximately 20 hollow-bearing trees were observed within Proposed Modification Areas 1 and 2, however none were observed in Proposed Modification Areas 3 to 6. The loss of hollow-bearing trees has the potential to impact on hollow-dependent fauna species, particularly threatened species. Despite this, the majority of such species are highly mobile (such as large birds and micro-bats), and the surrounding

woodland habitats are likely to contain similar densities of hollow-bearing trees as those within the Proposed Modification Areas.

Despite the loss of fauna habitat and of hollow-bearing trees from the Proposed Modification Areas, there are comparable resources within the Biodiversity Offset Areas, and broader surrounding areas and this loss is not likely to be significant.

It is not likely that the project will result in the loss of a significant amount of fauna habitat in the local area.

## 4.6 Impacts on Threatened Flora Species

One threatened flora species was recorded in the Proposed Modification Areas, being tricolour diuris (*Diuris tricolor*). Proposed Modification Area 1 was modified to reduce the impact on this species, such that a sub-population of 120 individuals of this species is now retained. Consequently, only three individuals of this species were recorded from the now Proposed Modification Area 1, however it was not recorded from any of the other Proposed Modification Areas despite the presence of potential habitat in the grassland or very open woodland habitats. The species has also been recorded in the Mangoola Coal Project area, Biodiversity Offset Areas and within local surrounding areas.

In addition to this, *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) has the potential to occur within the habitats of the Proposed Modification Areas. This recently-described orchid species is listed as critically endangered under the EPBC Act, however it is not listed under the TSC Act. This species has been recorded from the approved project disturbance area by Eastcoast Flora Surveys (2009a) and anecdotally from a similar area (Martin Rush pers. comm.). Both sets of records of this species record it from similar habitats to those of tricolour diuris (*Diuris tricolor*). Surveys of the Proposed Modification Areas targeted these two species during their appropriate flowering period, however only tricolour diuris (*Diuris tricolor*) was recorded. Despite this, there is potential that *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) could occur in the Proposed Modification Areas, particularly where tricolour diuris (*Diuris tricolor*) was recorded.

Due to the nature of the project, all vegetation within the Proposed Modification Areas will be removed, including the three recorded individuals of tricolour diuris (*Diuris tricolor*) and associated potential habitat. This will also remove potential habitat for *Prasophyllum* sp. Wybong (C. Phelps ORG 5269). An assessment of significance has been prepared for these impacts on tricolour diuris (*Diuris tricolor*) (see **Appendix D**). An assessment in accordance with the requirements of the EPBC Act has been undertaken for *Prasophyllum* sp. Wybong (C. Phelps ORG 5269), and is provided in **Appendix E**.

There are no other recorded threatened flora species that are considered to have a reasonable potential to be impacted by the project (**Appendix C**). Assessments of potential impacts have been prepared for those threatened flora species with potential habitat within the Proposed Modification Areas (**Appendix C**), and are considered to have the potential to be impacted by the project (see **Appendices D and E**).

The outcomes of both levels of assessment have found that the project is not likely to result in a significant impact on any occurring or potentially occurring threatened flora species.

## 4.7 Impacts on Endangered Flora Populations

One species comprising an endangered flora population was recorded in the Proposed Modification Areas, being tricolour diuris (*Diuris tricolor*). An assessment of significance has been completed to assess the impacts of the project on the Muswellbrook LGA population of *Diuris tricolor* (**Appendix D**). This assessment concluded that the project would not result in a significant impact on the endangered population of tricolour diuris (*Diuris tricolor*), despite likely impacts on the three individuals known from the Proposed Modification Areas.

## 4.8 Impacts on Threatened Ecological Communities

The Ironbark Woodland Complex recorded in the Proposed Modification Areas corresponds with Central Hunter Grey Box – Ironbark Woodland EEC, while the Slaty Box Woodland corresponds with the Hunter Valley Footslopes Slaty Gum Woodland VEC. Approximately 1.2 and 5.4 hectares of these communities (respectively) will be impacted as a result of the project. This impact will comprise clearing of all vegetation within each of the Proposed Modification Areas. An assessment of significance has been prepared to address the potential impacts on the Central Hunter Grey Box – Ironbark Woodland (see **Appendix D**), however such an assessment under the EP&A Act is not required for the Hunter Valley Footslopes Slaty Gum Woodland VEC.

The extent of impact on the Central Hunter Grey Box – Ironbark Woodland EEC does not constitute a significant loss of this community at either a local or regional scale.

## 4.9 Impacts on Threatened Fauna Species

No threatened fauna species were recorded during opportunistic fauna surveys of the Proposed Modification Areas. A number of threatened fauna species recorded from the broader area as part of the Anvil Hill Project EA (Umwelt 2006), and ongoing ecological monitoring completed by Umwelt (2007-8) and Forest Fauna Surveys/Eastcoast Flora Survey (2008-9) have the potential to use the habitats of the Proposed Modification Areas. These have been considered in **Appendix C**.

The impacts on fauna species from the project are likely to arise from the removal of vegetation, particularly hollow-bearing trees. Given the high degree of existing vegetation fragmentation within the Proposed Modification Areas, it is not likely that this removal of small amounts of vegetation will result in further fragmentation impacts on threatened fauna species. It is likely that any threatened species that would potentially use the habitats of the Proposed Modification Areas would not be impacted by this relatively minor increase in fragmentation, due to their high degrees of mobility.

A higher degree of impact is likely to come from the loss of hollow-bearing trees within Proposed Modification Areas 1 and 2. Approximately 20 hollow-bearing trees were observed in these areas during the current surveys, and it is likely that all of these would require removal. The potential impacts of the loss of such trees come from the loss of roosting/nesting resources, as well as direct injury or death from (or as a result of) the tree felling process. To address these impacts, an appropriately designed and maintained nest box program will be implemented to compensate for the loss of hollow resources. Such programs can be effective, provided that boxes of suitable and varied design and sizes are provided, and that they are regularly maintained, replaced if faulty and monitored for feral species.

To minimise direct injury or death from the felling process, a detailed pre-clearing survey procedure will be implemented, as will a tree-felling procedure aimed at minimising potential harm, as much as possible. Both approaches will be adopted to address this impact on threatened fauna species, and these are discussed in further detail in **Section 5.0** of this report.

An assessment of significance has been completed for the following potentially occurring threatened fauna species (as a result of their hollow-dependence and recorded presence in the Mangoola Coal Project area), and is provided in **Appendix D**:

- glossy black-cockatoo (*Calyptorhynchus lathamii*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- turquoise parrot (*Neophema pulchella*);
- little lorikeet (*Glossopsitta pusilla*);
- masked owl (*Tyto novaehollandiae*);
- powerful owl (*Ninox strenua*);
- squirrel glider (*Petaurus norfolkensis*);
- eastern freetail-bat (*Mormopterus norfolkensis*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- large-footed myotis (*Myotis adversus*); and
- greater broad-nosed bat (*Scoteanax rueppellii*).

The assessment of significance (**Appendix D**) has concluded that (in considering the mitigation measures discussed in **Section 5.0**) the project is not likely to result in a significant impact on threatened fauna species within the Proposed Modification Areas.

## 4.10 Impacts on Critical Habitat

There are four areas of Critical Habitat declared under the TSC Act, these being:

- Cabbage Tree Island, Port Stephens, Critical Habitat for the Goulds Petrel (*Pterodroma leucoptera leucoptera*);
- North Sydney Harbour, Critical Habitat for the Little Penguin (*Eudyptula minor*);
- Stotts Island Nature Reserve, Critical Habitat for the Mitchells Rainforest Snail (*Thersites mitchellae*); and
- Wollemi National Park, Critical Habitat for the Wollemi pine (*Wollemia nobilis*).

There are a further two locations recommended as Critical Habitat:

- Bomaderry bushland, Shoalhaven, Critical Habitat for the Bomaderry zieria (*Zieria baeuerlenii*); and
- Critical Habitat for the Eastern Suburbs Banksia Scrub EEC.

None of the above listed Critical Habitats or recommended Critical Habitats occur within the Proposed Modification Areas. There are no listings under the EPBC Act for Critical Habitat.

#### 4.11 Impacts from Key Threatening Processes

A number of Key Threatening Processes (KTPs) listed under the Schedules of the TSC Act, the EPBC Act and the FM Act, are relevant to the project. Each of the relevant KTPs is listed in **Table 4.1**, along with a discussion of the relevance to the project.

**Table 4.1 – Key Threatening Processes and their Relevance to the Project**

| Key Threatening Process                                          | Legislation | Relevance/Implications                                                                                                                                                                                                         |
|------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clearing of native vegetation                                    | TSC Act     | Clearing of vegetation is the most consequential impact of the project. Approximately 11.7 hectares will be disturbed, 44% of which is Disturbed Grassland. The remaining 56% of clearing will occur within Woodland habitats. |
| Land clearance                                                   | EPBC Act    | As above.                                                                                                                                                                                                                      |
| Invasion of native plant communities by exotic perennial grasses | TSC Act     | There is only low potential that the project would lead to an increase in the extent of exotic perennial grasses due to the disturbance required.                                                                              |
| Removal of dead wood and dead trees                              | TSC Act     | The project will result in the removal of some dead wood habitat. If this habitat is not damaged and left <i>in situ</i> or relocated into adjacent bushland areas this will minimise the implications of this KTP.            |
| Loss of hollow-bearing trees                                     | TSC Act     | The project will result in the removal of approximately 20 hollow-bearing trees. Appropriate mitigation measures have been provided in <b>Section 5.0</b> , to ensure that the implications of this action are minimised.      |

#### 4.12 EPBC Matters of National Environmental Significance

Under the Commonwealth EPBC Act, approval from the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (NES). These matters are:

- listed threatened species and ecological communities;
- migratory species protected under international agreements;
- Ramsar wetlands of international importance;
- the Commonwealth marine environment;
- World Heritage properties;
- National Heritage places;
- Great Barrier Reef Marine Park; and
- nuclear actions.

Each of these is discussed further in **Table 4.2**.

**Table 4.2 – Assessment of EPBC Act Matters of National Environmental Significance**

| <b>Matter of National Environmental Significance</b>                                                                                                                            | <b>Potential to Occur within the Proposed modification areas</b>                                                                                                                                                              | <b>Potential for Significant Impact</b>                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| The world heritage values of declared World Heritage properties.                                                                                                                | Wollemi National Park, which occurs approximately 10 km to the south of the Proposed Modification Areas, is listed as a World Heritage Area.                                                                                  | The project will not impact on this World Heritage property.                                                               |
| The national heritage values of places on the National Heritage List.                                                                                                           | There are no National Heritage Listed places within or in proximity to the Proposed Modification Areas.                                                                                                                       | No National Heritage Listed places will be impacted as a result of the project.                                            |
| The ecological character of declared Ramsar wetlands.                                                                                                                           | The Proposed Modification Areas do not occur within or near a declared Ramsar wetland. The closest declared Ramsar wetland is the Hunter River Estuary, at least 150 km to the south-east of the Proposed Modification Areas. | The project will not have a significant impact on Ramsar wetlands.                                                         |
| Threatened species (other than extinct and conservation-dependent species) and ecological communities (other than vulnerable ecological communities) listed under the EPBC Act. | A number of EPBC Act listed threatened species have been recorded or have potential to occur within the Proposed Modification Areas and may be impacted by the project.                                                       | There will be no significant impact on any listed threatened species or ecological communities as a result of the project. |
| Migratory species listed under the EPBC Act.                                                                                                                                    | A number of EPBC Act listed migratory bird species have potential to occur within the Proposed Modification Areas and may be impacted by the project.                                                                         | There will be no significant impact on any listed migratory species as a result of the project.                            |
| Great Barrier Reef Marine Park                                                                                                                                                  | The project does not have the potential to impact on the Great Barrier Reef Marine Park.                                                                                                                                      | There will be no significant impact on the Great Barrier Reef Marine Park as a result of the project.                      |
| Nuclear actions that are likely to have a significant impact on the environment.                                                                                                | The project does not involve any nuclear actions.                                                                                                                                                                             | The project does not involve any nuclear actions that may have a significant impact on the environment.                    |
| The Commonwealth marine environment.                                                                                                                                            | The Proposed Modification Areas are not within the Commonwealth marine environment.                                                                                                                                           | The project will not have a significant impact on any areas of the Commonwealth marine environment.                        |

Of these matters, *Bothriochloa biloba*, *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) and *Thesium australe* have been recorded within the local area (Umwelt 2006, Umwelt 2009, Eastcoast Flora Survey 2009a), and are considered to have the potential to occur within the Proposed Modification Areas. The potential impacts of the project on these are provided by way of an assessment of significance in **Appendix E**.

This assessment has concluded that the project is not likely to have a significant impact on matters of NES, however this project will be referred to the Commonwealth Minister for the Environment, Heritage and the Arts, for consideration of this conclusion. The Commonwealth Minister has since deemed that the project is not a controlled action.

#### **4.13 Fisheries Management Act 1994**

The Hunter River catchment does not provide habitat for any of the threatened aquatic species, populations and endangered ecological communities listed under the FM Act.

No threatened aquatic species, populations or ecological communities were recorded within the Anvil Hill Project EA (Umwelt 2006), and there is no potential for any to occur within the Proposed Modification Areas.

## 5.0 Impact Mitigation Measures

This section describes the detailed impact mitigation strategy that has been developed to ameliorate the impacts of the project on threatened species, endangered populations, TECs and their habitats. The primary approach to this has been to initially avoid ecological impact. Where such an impact has been unavoidable, attempts have been made to minimise impacts, and then provision has been made to offset those unavoidable impacts. This section discusses the measures included in the design of the project to avoid and minimise ecological impacts. **Section 6.0** discusses a Biodiversity Offset Package which has been designed to address residual ecological impacts. In combination, the impact mitigation and biodiversity offsetting proposed as part of this project seeks to achieve the overall goal to maintain or improve the biodiversity values of the local area.

The loss of 11.7 hectares of vegetation within the Proposed Modification Areas is not likely to result in major impacts on the biodiversity of the local area. This is particularly so, when considering that 44 per cent of the vegetation to be removed is Disturbed Grassland that has been heavily cleared and modified in the past. Despite this, it is appropriate to implement mitigation measures for those impacts that have not been able to be avoided and will occur as a result of the project.

### 5.1 Measures to Avoid or Minimise Impact

This section discusses measures that were applied during a constraints analysis undertaken as part of the project design in order to avoid or, where avoidance was not feasible, minimise potential impact on target ecological features of the Proposed Modification Areas and surrounding area. These measures were developed and included in response to specific ecological impact issues. These measures have been included within the final design of the project and thus have been considered within the impact assessment provided in **Section 4.0**.

#### 5.1.1 Project Modification Adopted to Avoid Potential Impacts

The overarching principles employed in the planning of the project were to avoid, minimise and then mitigate unavoidable ecological impacts as much as possible, while allowing a viable project outcome. In adopting this approach, it was acknowledged that it is not possible to fully avoid or minimise all potential ecological impact from large-scale projects such as this one.

##### 5.1.1.1 Redesign of Proposed Modification Area 1

The current design of Proposed Modification Area 1 is the result of a redesign of its boundaries, following the identification of a substantial sub-population of tricolour diuris (*Diuris tricolor*) within the original boundary for this area. During field surveys of the original Proposed Modification Area 1 boundary, a sub-population of at least 120 individuals of tricolour diuris (*Diuris tricolor*) was recorded in the northern end of this Proposed Modification Area (see **Figure 3.2**). Three further individuals were recorded further south, however still within the original boundary.

Given the likely significant impact that would arise from disturbance to such a substantial sub-population of this species, it was agreed to redesign the boundary of the Proposed Modification Area to exclude this sub-population from impact. This has resulted in the reduction in size of the Proposed Modification Area from 8.7 hectares to 8.4 hectares, which will retain this sub-population of the species within an undisturbed portion of the existing Habitat Enhancement Area. This redesign has resulted in a reduction in the potential significance of this impact, to a relatively low level.

This alteration to the original project design has contributed to a substantial reduction in the overall impact of the project on the significant ecological features of the Proposed Modification Areas, by way of avoiding or minimising likely impacts on tricolour diuris (*Diuris tricolor*). This modification was introduced during project planning and design, and in response to field survey results and preliminary impact assessments.

## 5.2 Tree Felling and Loss of Hollows

The loss of hollow-bearing trees will be the primary impact of this project on threatened fauna species, and impact mitigation measures can be implemented to ensure that these impacts are minimised. Undertaking a detailed pre-clearing survey and tree-felling process will ensure that potential injury or death to fauna species (particularly threatened fauna species) from tree felling is kept to a minimum.

Mangoola Coal has an existing commitment to a detailed pre-clearing and tree-felling procedure designed to minimise impacts on fauna species. These procedures would apply for all of the Proposed Modification Areas where there is a requirement to remove woody native vegetation (including shrublands and scattered trees within grasslands). These commitments generally involve ecological survey of all areas requiring clearing prior to any clearing works being undertaken. The purpose of the pre-clearance survey is to identify fauna species inhabiting hollows to be cleared. If resident fauna are identified, measures will be adopted to attempt to avoid injury or death of these species. The requirements of each of these procedures are identified within the Anvil Hill Project EA (Umwelt 2006), and are also outlined in the Draft ROMP (Umwelt, in prep.). These procedures will also be followed for the removal of any woody native vegetation (including shrublands and scattered trees in grassland) for the purposes of this project, both within the approved project disturbance area, and within the Proposed Modification Areas.

In addition, Mangoola Coal has a detailed nest box strategy in place, which ensures the replacement of felled hollows with suitably-designed nest boxes, targeted for a range of fauna groups. The strategy requires regular maintenance checks of these boxes, and monitoring to remove feral species and assess if they are being utilised by target faunal groups. This nest box strategy was detailed in the Anvil Hill Project EA (Umwelt 2006), and will be included in more detail within the Draft ROMP (Umwelt, in prep.). This strategy will ensure that there will be no net loss of hollows as a result of the Mangoola Coal Project.

## 5.3 General Mitigation Measures

In addition to the above measures, the following measures will be implemented (as much as possible), in order to minimise impacts resulting from the project:

- Prior to the commencement of any clearing or construction in Proposed Modification Area 3, a qualified and experienced ecologist will survey the general vicinity of the area to clearly identify if any sapling weeping myalls (*Acacia pendula*) are present in the proximity of the area to be impacted. At the time of survey, no plants were recorded in or within approximately 50 metres of this area, however there is potential that saplings could appear and be impacted. The ecologist will identify and mark all known occurrences of this species to ensure vehicle movements and ancillary activities associated with construction works do not impact on this species; and
- all examples of the tiger orchid (*Cymbidium canaliculatum*), if recorded within areas to be cleared, will be included in and treated according to the translocation program for the Mangoola Mine, as per the Draft ROMP (Umwelt, in prep.).

## 6.0 Biodiversity Offsetting

The Biodiversity Offset Strategy presented in this section has been developed progressively, and is included as an integral component of this project. This strategy is designed to address the likely residual impacts on threatened species, endangered populations, TECs and their habitats within the Proposed Modification Areas, as described in **Section 4.0** of this report. Those residual impacts are those that have not been able to be avoided, or fully minimised by the measures discussed in **Section 5.0**.

### 6.1 Introduction

It is generally expected that for sites which support at least moderate condition native vegetation and fauna habitat biodiversity offsetting should be provided to ameliorate the impacts of development. Over the course of the last 5-10 years, biodiversity offsets have been used in NSW as an effective measure to ameliorate development impacts on biodiversity. While there are no consistent, universally applied guidelines, it has generally been accepted that in principle, biodiversity offsets should be:

- located as close as possible to the areas subject to impact, depending on the availability of such areas;
- appropriately monitored and managed for biodiversity outcomes;
- appropriately protected; and
- usually at least as large as the area impacted.

Although these principles are not universally employed, it is recognised that they form an appropriate approach around which individual development offsets are assessed. In the past, biodiversity offsetting has taken the form of:

- developers (including mining companies) managing land that is set aside for biodiversity conservation;
- developers donating land to DECCW or other similar bodies; and
- financial contributions to the government to fund land purchases or management, or threatened species recovery.

DECCW has released guidelines titled *Principles for the Use of Biodiversity Offsets in NSW* (DECCW 2008). These guidelines provide a more formal approach through which biodiversity offsetting can be measured, and incorporate some of the principles enshrined in the DECCW BioBanking scheme (see **Section 6.2**). The DECCW (2008) principles state that:

- impacts must be avoided first by using prevention and mitigation measures;
- all regulatory requirements must be met;
- offsets must never reward ongoing poor performance;
- offsets will complement other government programs;
- offsets must be underpinned by sound ecological principles;

- offsets must be enduring and they must offset the impact of the development for the period that the impact occurs;
- offsets should be agreed prior to the impact occurring;
- offsets must be quantifiable and the impacts and benefits must be reliably estimated;
- offsets must be targeted;
- offsets must be located appropriately;
- offsets must be supplementary; and
- offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.

**Section 6.4** documents how the above DECCW biodiversity offsetting principles have been incorporated into the proposed impact mitigation strategy for the Project.

## 6.2 BioBanking

The NSW Government developed the BioBanking scheme to enable a more consistent approach to biodiversity offsetting. It forms an alternative approach against which developments can be assessed and through which developers can achieve appropriate biodiversity offsetting without having ongoing management or legal responsibility for the offset areas. Participation in BioBanking is voluntary and the potential for utilising this recently developed and still evolving option is discussed below.

The BioBanking scheme works through applying a rule-based approach to determining the likely impact a development will have on biodiversity, and through then calculating the number of *biodiversity credits* (comprising *ecosystem credits* and/or *threatened species credits*) that are required to be purchased to offset the development's impact. The credits are purchased from registered BioBanking Sites and the funds generated from the purchase are used by the BioBanking site manager(s) to achieve a set of previously-agreed management actions at that site(s). This process is known as credit retirement, and once the developer has purchased all of the necessary credits, their development has been offset and they have no further responsibility to any biodiversity offsetting requirements. BioBanking sites will be protected, managed and funded in-perpetuity. The scheme provides an alternative assessment pathway for offsetting the impact of a development. In this circumstance, Xstrata Mangoola has land available to supplement existing offset areas and this approach is considered preferable for this project.

Although the project is not required to adopt the BioBanking scheme, it is recognised that many of the principles established under the BioBanking scheme are of relevance. These have been considered in the development of the impact mitigation and biodiversity offset package for this project.

## 6.3 Proposed Biodiversity Offset Strategy

In order to address residual impacts of the project on threatened species, endangered populations, TECs and their habitats, a Biodiversity Offset Strategy is provided. This Strategy focuses on the provision of an additional formal offset area within the Mangoola Coal-owned additional biodiversity offset area, which lies to the south of and adjoins the

existing Biodiversity Offset Area established through the project approval process for the Mangoola Coal Project. The Biodiversity Offset Strategy provides for the protection of this offset area, as well as ongoing management actions to ensure its ecological integrity in the long term.

The Biodiversity Offset Strategy proposed as part of this modification project, adds to the Biodiversity Offset Strategy proposed as part of the proposed relocation of the 500 kV transmission line project (addressed within the Environmental Assessment). As part of that project, a 30 hectare portion of the additional biodiversity offset area was offset as part of an additional Biodiversity Offset Package to address ecological impacts of the relocation of the 500 kV transmission line. The Biodiversity Offset Package for this modification project offers an additional 34 hectare portion of the additional biodiversity offset area to address unavoidable impacts from this project. Both Biodiversity Offset Strategies have been designed to provide a coordinated offsetting approach for both projects, providing the same management requirements for both parcels of land.

### 6.3.1 Additional Biodiversity Offset Area

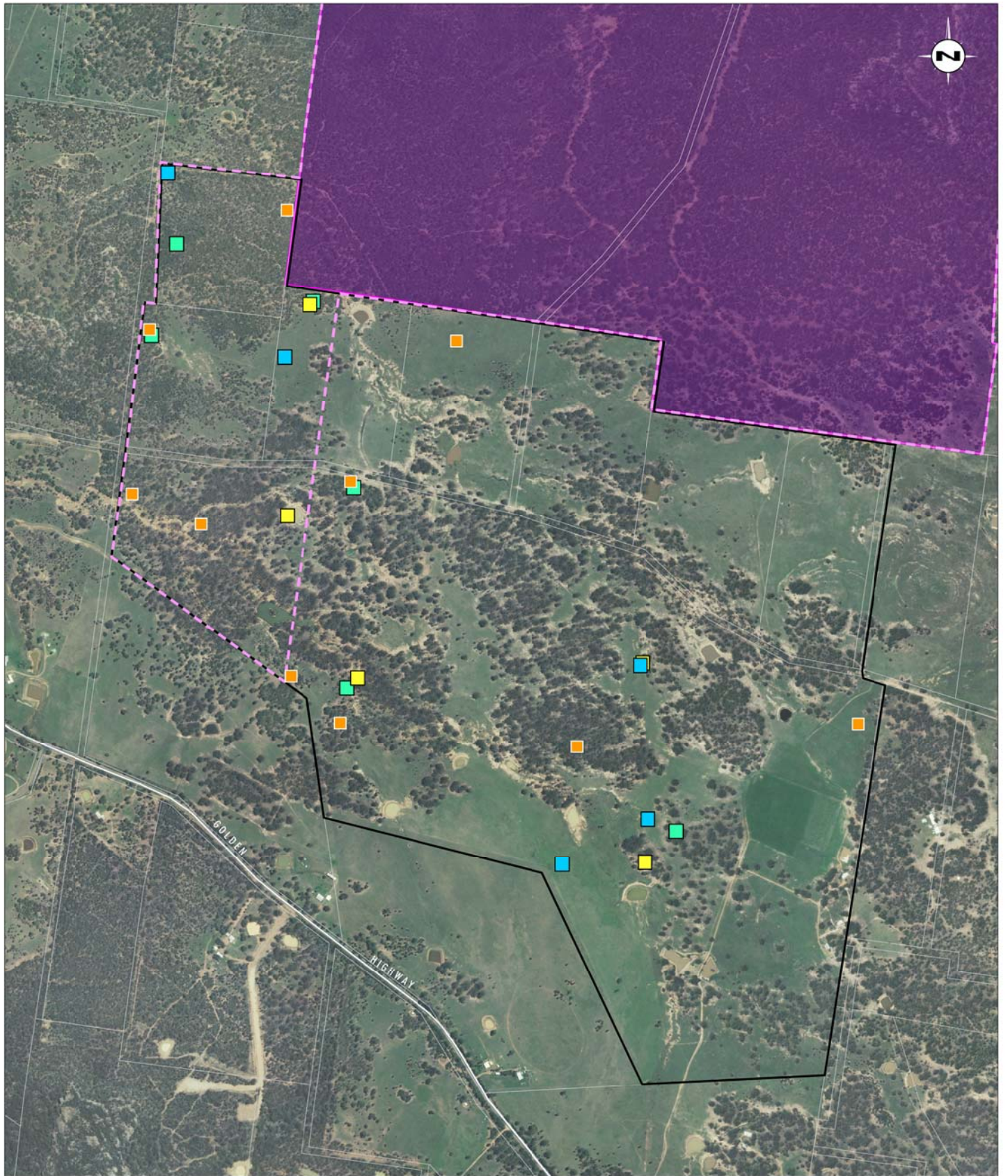
The additional biodiversity offset area is part of the former 'Nipol' property which has been recently purchased by Xstrata Mangoola. This property is 335 hectares in size, and lies to the south of the approved Biodiversity Offset Area for the Mangoola Coal Project (**Figure 6.1**), adjoining the southern part of the Conservation Offset Area. Historically, the property has been used for agricultural purposes such as cattle grazing, and there is currently a small vineyard (with associated dwelling, sheds, etc.) in the eastern parts of the property. Approximately half of the property is covered with woody vegetation, with the remainder comprising grasslands.

In order to offset the impacts of this modification project, a 34 hectare portion of this property is being proposed as a formal offset area (the additional biodiversity offset area). This portion is being offered in addition to the 30 hectares offered as part of the 500 kV transmission line project. The additional 34 hectares lie on the eastern side of the existing 30 hectare portion of the property (**Figure 6.2**), thereby widening the intended vegetated link between the Conservation Offset Area for the Mangoola Coal Project site, to vegetation adjoining the Golden Highway, and south into the conserved habitats of the Myambat Military Area.

This additional biodiversity offset area is proposed in order to offset impacts from the project on:

- parts of the Proposed Modification Areas 1, 3, 4, 5 and 6 which will remove native vegetation and fauna habitats, as well as remove area from the existing Biodiversity Offset Areas for the Mangoola Coal Project; and
- Proposed Modification Area 2 which lies outside of the existing Biodiversity Offset Areas, however will impact on native vegetation and fauna habitats.

To this end, the 34 hectares offered as an offset for this project will replace the areas lost from the existing Biodiversity Offset Areas, as well as offset residual impacts from the Proposed Modification Areas. This approach will ensure that the total extent of the existing Biodiversity Offset Areas will not be reduced as a result of this project, rather will be maintained and augmented with an appropriate amount of suitable vegetation to compensate for the impacts from the Proposed Modification Areas.



Source: Dept. of Lands (2003), Xstrata Mangoola (2010)

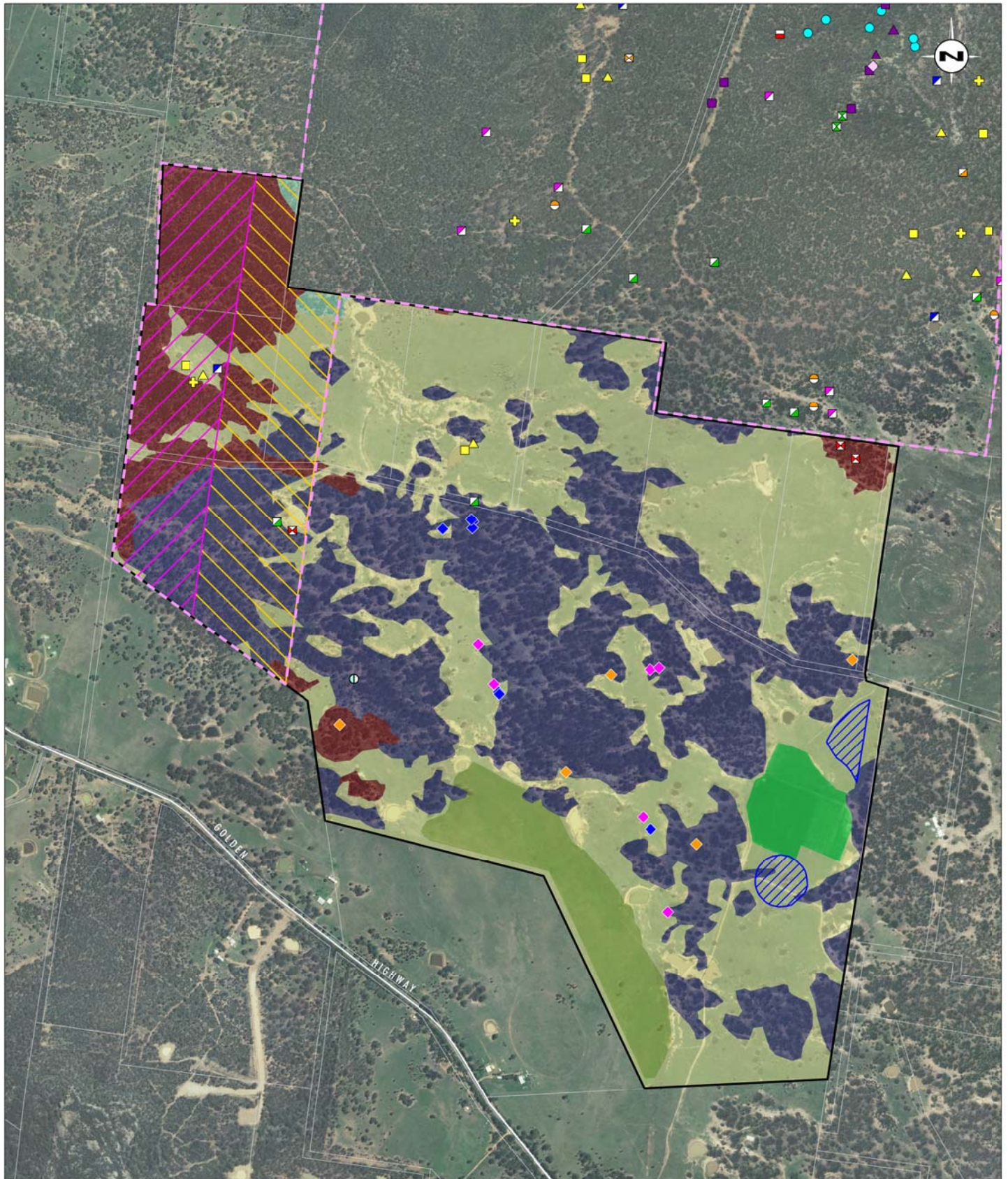
0 200 400 800m

#### Legend

- Project Area
- Former Nipol Property
- Conservation Offset Area
- Habitat Assessment
- Flora Quadrat
- Rapid Assessment
- Opportunistic Bird/Herpetological Survey

FIGURE 6.1

Survey Locations for Proposed  
Additional Biodiversity Offset Area



Source: Dept. of Lands (2003), Xstrata Mangoola (2010)

#### Legend

- Project Area
- Former Nipol Property
- Proposed ETL Relocation Offset Area (30 hectares)
- Proposed Modification Additional Biodiversity Offset Area (34 hectares)
- Slaty Box Woodland (VEC, TSC Act)
- Ironbark Woodland Complex (EEC, TSC Act)
- Modified Native Grassland
- Vineyard
- Forest Red Gum Riparian Woodland
- Improved Pasture

- Bothriochloa biloba* Area
- ◆ *Acacia pendula*
- ◆ *Acacia hamulophylla-pendula*
- *Cymbidium canaliculatum*
- *Lasiopetalum longistamineum*
- ▲ *Pomaderris queenslandica*
- *Pomaderris reperta*
- Brown Treecreeper
- Brush-tailed Rock-wallaby
- Diamond Firetail

- ▲ Eastern Bentwing-bat
- Eastern Cave Bat
- ◆ Eastern False Pipistrelle
- + Eastern Freetail-bat
- ◆ Grey-crowned Babbler
- Hooded Robin
- Koala
- Large-eared Pied Bat
- Large-footed Myotis
- Little Lorikeet

- Speckled Warbler

FIGURE 6.2  
Proposed Additional  
Biodiversity Offset Area

### 6.3.2 Ecological Surveys of Additional Biodiversity Offset Area

Once it was identified as a potential offsetting resource, the additional biodiversity offset area was subject to ecological survey to document its ecological features, and thereby its suitability as an offset for the residual impacts associated with the Proposed Modification Areas.

These surveys were completed between 15 and 17 February 2010, and covered the entire additional biodiversity offset area. The whole property (335 hectares) was surveyed in order to enable the informed selection of appropriate areas to offset the ecological impact of the project. Surveys consisted of:

- vegetation mapping and targeted threatened flora searches (including 10 flora plots, five rapid assessment sites and walking transects);
- habitat assessments;
- fauna surveys covering three general sites, comprising diurnal bird and herpetofauna surveys, SEPP 44 habitat assessments, as well as nocturnal spotlighting, call playback and Anabat echolocation surveys; and
- opportunistic diurnal bird and herpetofauna surveys.

Each flora plot had dimensions of 20 metres by 20 metres (400 m<sup>2</sup>), which is a standard size used widely for systematic flora surveys throughout NSW and is recognised by the DECCW and the Royal Botanic Gardens Sydney. Within each plot, two ecologists spent approximately 45 minutes to 1 hour searching for species, walking along-side each other in parallel lines throughout the extent of the plot.

All species encountered within the plot were recorded, and a modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with modifications by Poore 1955 and Austin *et al.* 2001) was used to estimate the cover-abundances of each species (**Table 6.1**).

**Table 6.1 - Modified Braun-Blanquet Crown Cover-abundance Scale**

| Class | Cover-abundance*                      | Notes                                                                                                                              |
|-------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Few individuals (less than 5% cover)  | Forbs, sedges and grasses: < 5 individuals<br>Shrubs and small trees: < 5 individuals                                              |
| 2     | Many individuals (less than 5% cover) | Forbs, sedges and grasses: 5 or more individuals<br>Shrubs and small trees: 5 or more individuals<br>Medium-large overhanging tree |
| 3     | 5 – less than 20% cover               | N/A                                                                                                                                |
| 4     | 20 – less than 50% cover              | N/A                                                                                                                                |
| 5     | 50 – less than 75% cover              | N/A                                                                                                                                |
| 6     | 75 – 100% cover                       | N/A                                                                                                                                |

**Note:** \* Modified Braun-Blanquet scale (Braun-Blanquet 1927; Poore 1955; Austin *et al.* 2000).

Information on the structural characteristics of the vegetation in each plot was also recorded, including the height range, canopy cover and the dominant species of each stratum. Information on the general health and condition of the vegetation within each plot was also recorded, including presence of weeds, disturbances such as fire and feral animals, and evidence of dieback or insect attack.

Rapid vegetation assessments were completed primarily to assist in the delineation and refinement of vegetation mapping. These assessment sites were located within each broadly mapped vegetation community to allow data collection for each community without confounding effects from adjacent communities. Dominant, common and some uncommon plant taxa were recorded within each vegetation community along meandering transects, carried out on foot, at each location.

The rapid vegetation assessments did not utilise a quantitative sampling approach, as this method was designed to allow rapid collection of non-quantitative species dominance data across the project area within limited timeframes. A meandering technique was selected instead of the plot-based method because it increased the amount of data that could be collected within the available survey time, thereby maximising the quality and coverage of vegetation description and mapping.

The relative abundance of vascular plants recorded within each vegetation community was determined using the cover-abundance score identified in **Table 6.1**.

The remaining methods applied as part of these surveys are as per those described in **Sections 2.2** and **2.3** of this report. The location of surveys completed in the additional biodiversity offset area is displayed in **Figure 6.1**.

### 6.3.3 Ecological Features of Additional Biodiversity Offset Area

The following sections provide a description of the existing ecological values of the additional biodiversity offset area, with particular focus on significant ecological features such as threatened species, endangered populations, TECs and their habitats.

#### 6.3.3.1 Vegetation and Vegetation Communities

Five vegetation communities were identified in the additional biodiversity offset area (refer to **Figure 6.2**). Descriptions of these communities are provided in the following sections, where they differ from those described in **Section 3.1.2** of this report.

##### Slaty Box Woodland

The Slaty Box Woodland within the additional biodiversity offset area is consistent with the Slaty Box Woodland present within the Mangoola Coal Project area. See **Section 3.1.2.1** for the floristic and structural description of this community. This community is consistent with the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC, listed under the TSC Act.

##### Ironbark Woodland Complex

The Ironbark Woodland Complex is generally consistent with the Ironbark Woodland Complex present within the Mangoola Coal Project area. See **Section 3.1.2.2** for the floristic and structural description of this community.

Two variants were identified within this community, where rough-barked apple (*Angophora floribunda*) and forest red gum (*Eucalyptus tereticornis*) are the dominant canopy species. The understorey species, however, remain consistent with those commonly recorded in the Ironbark Woodland Complex. These variants are only present in small remnants in the south-west of the additional biodiversity offset area and are consequently heavily influenced by surrounding grassland and woodland communities.

The Ironbark Woodland Complex is consistent with the Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC listed under the TSC Act, where the dominant canopy species is narrow-leaved ironbark or grey box.

### Forest Red Gum Riparian Woodland

Forest Red Gum Riparian Woodland is found adjacent to an unnamed drainage line in the north-east of the additional biodiversity offset area. The dominant canopy species is forest red gum (*Eucalyptus tereticornis*), up to approximately 25 metres in height and 10-30 per cent cover. Grey box (*Eucalyptus moluccana*), narrow-leaved ironbark (*Eucalyptus crebra*) and bullock (*Allocasuarina luehmannii*) also occur sporadically within this community.

A low tree stratum dominated by white feather honeymyrtle (*Melaleuca decora*) (of between 2 and 10 metres) is commonly present, occurring sparsely or forming a dense understorey layer. There is usually little or no understorey within this community. Species such as native olive (*Notelaea microcarpa* var. *microcarpa*) and narrow-leaved wattle (*Acacia linearifolia*) were also recorded.

A sparse to mid-dense (30-60 per cent cover) groundcover is present, usually less than 0.3 metre in height. The groundcover is highly variable, and is strongly influenced by the surrounding vegetation as this community occurs in a narrow band on the flats and lower slopes adjacent to the drainage line. Common native species include open summer-grass (*Digitaria diffusa*), yellow burr daisy (*Calotis lappulacea*), barbed wire grass (*Cymbopogon refractus*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), kidney weed (*Dichondra repens*), common fringe-rush (*Fimbristylis dichotoma*), twining glycine (*Glycine clandestina*) and native wandering Jew (*Commelina cyanea*). Introduced groundcover species are relatively uncommon, however common prickly pear (*Opuntia stricta* var. *stricta*) and tiger pear (*Opuntia aurantiaca*) occur in relatively low abundance.

This community occurs as a mosaic of the Forest Red Gum Riparian Woodland and Paperbark Woodland, mapped as part of the Anvil Hill Project EA (Umwelt 2006), and there is difficulty in delineating the two communities. The community occurring in this mosaic pattern is similar to what was identified within the Anvil Hill project area. Consequently this community has similarities to, or is partially equivalent to, MU 13 Hunter Floodplain Red Gum Woodland Complex and MU 17 Central Hunter Paperbark Soaks Woodland of Peake (2006), however, within the additional biodiversity offset area, the community does not occur on a floodplain. The similarity of this community to MU 13 is limited to the presence of forest red gum and few ground cover species, and it is considered to be more floristically similar to MU 17. However, given the narrow width of the community, its species composition is also influenced by the Ironbark Woodland Complex. Peake (2006) indicated that MU 17 may meet the DEH (2006) criteria for listing as an EEC, however there has been insufficient systematic sampling carried out in MU 17, and more should be undertaken to determine its conservation significance.

### Modified Native Grassland

The Modified Native Grassland within the additional biodiversity offset area is broadly similar to the Disturbed Grassland present within the Mangoola Coal Project area, described in **Section 3.1.2.3**. The main difference between these communities is the higher native species diversity present in the Modified Native Grassland, which generally contains relatively few introduced species, which are present in low abundance.

The dominant species present include slender rats tail grass (*Sporobolus creber*), windmill grass (*Chloris truncata*), paddock lovegrass (*Eragrostis leptostachya*), Queensland bluegrass (*Dichanthium sericeum*), silky browntop (*Eulalia aurea*), three-awn speargrass (*Aristida vagans*), common fringe-sedge (*Fimbristylis dichotoma*), yellow buttons (*Chrysocephalum*

*apiculatum*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*) and *Phyllanthus virgatus*. Small-leaved bluebush (*Maireana microphylla*) is scattered throughout this community.

Introduced species are generally present in low abundance. The most commonly recorded introduced species include fireweed (*Senecio madagascariensis*), paspalum (*Paspalum dilatatum*), narrow-leaved cotton bush (*Gomphocarpus fruticosus*) and flaxleaf fleabane (*Conyza bonariensis*).

Scattered slaty box (*Eucalyptus dawsonii*), narrow-leaved ironbark (*Eucalyptus crebra*) and bulloak (*Allocasuarina luehmannii*) are present within this community. Based on the presence of these species and surrounding woodland remnants, this community is likely to be the result of historical clearing of Slaty Box Woodland and Ironbark Woodland Complex. If these grassland areas are able to regenerate into woodland communities are likely to form part of the Central Hunter Grey Box – Ironbark Woodland EEC or the Hunter Valley Footslopes Slaty Gum Woodland VEC listed under the TSC Act. In its current condition, the Modified Native Grassland is not consistent with the EEC or VEC.

A variation of this community is present in the eastern portion of the additional biodiversity offset area, in which the species composition of grasses and forbs differs from that of the rest of the native grassland areas. This area is dominated by red grass (*Bothriochloa biloba*) (listed as vulnerable under the EPBC Act), *Bothriochloa macra*, *Digitaria divaricatissima*, *Eriochloa pseudoacrotricha*, yellow burr daisy (*Calotis lappulacea*), *Atriplex semibaccata*, *Sida subspicata*, and *Oxalis perennans*. A higher diversity of introduced species was recorded in this variant, which includes narrow-leaved cotton bush (*Gomphocarpus fruticosus*), saffron thistle (*Carthamus lanatus*) and galenia (*Galenia pubescens*).

### Improved Pasture

The Improved Pasture is located in the south of the additional biodiversity offset area. It has been subject to greater disturbance, increased nutrients or a combination of the two and consequently has a greater proportion of introduced species.

Native species present within the Improved Pasture include windmill grass (*Chloris truncata*), couch (*Cynodon dactylon*), common fringe-sedge (*Fimbristylis dichotoma*), paddock lovegrass (*Eragrostis leptostachya*), slender rats tail grass (*Sporobolus creber*), umbrella grass (*Digitaria divaricatissima*) and two-colour panic (*Panicum simile*). Introduced species are common and occur in moderate abundance. Commonly recorded introduced species include Paddys lucerne (*Sida rhombifolia*), galenia (*Galenia pubescens*), Rhodes grass (*Chloris gayana*), perennial ryegrass (*Lolium perenne*) and gomphrena weed (*Gomphrena celosioides*).

As this is not a naturally occurring community and it contains a high proportion of introduced species, it has low conservation significance.

The area of each community is shown in **Table 6.2**.

**Table 6.2 – Vegetation Communities of the Additional Biodiversity Offset Area**

| <b>Vegetation Community</b>      | <b>Conservation Significance*</b>                                                                                                                                                                                             | <b>Amount within additional biodiversity offset area (ha)</b> | <b>Amount within Offset for Proposed Modification Areas</b> | <b>Amount within Overall Additional Biodiversity Offset Area**</b> |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------|
| Ironbark Woodland Complex        | Common and widespread in the local area and the central Hunter Valley. Moderate conservation significance. Consistent with Central Hunter Grey Box – Ironbark Woodland EEC listed under the TSC Act.                          | 36.4                                                          | 10.2                                                        | 21.0                                                               |
| Slaty Box Woodland               | Moderately widespread in the local area. Consistent with Hunter Valley Footslopes Slaty Gum Woodland VEC listed under the TSC Act.                                                                                            | 127.2                                                         | 14.8                                                        | 30.7                                                               |
| Forest Red Gum Riparian Woodland | Relatively uncommon in the local area, and of moderate to high conservation significance.                                                                                                                                     | 1.4                                                           | 1.2                                                         | 1.2                                                                |
| Modified Native Grassland        | Moderate abundance in the local area. Not a naturally occurring community, and therefore mostly has low conservation significance, although has potential to regenerate into Slaty Box Woodland or Ironbark Woodland Complex. | 147.4                                                         | 7.8                                                         | 11.1                                                               |
| Improved Pasture                 | Moderate abundance in the local area. Not a naturally occurring community, and therefore mostly has low conservation significance.                                                                                            | 16.8                                                          | 0.0                                                         | 0.0                                                                |
| <b>Total</b>                     |                                                                                                                                                                                                                               | <b>335</b>                                                    | <b>34.0</b>                                                 | <b>64.0</b>                                                        |

\*Based on expert opinion, and drawing on Peake (2006) where equivalent vegetation communities exist.

\*\*Includes vegetation proposed as offset for proposed relocation of 500 kV ETL.

As shown in **Table 6.2** and **Figure 6.2**, the Modified Native Grassland and Slaty Box Woodland are the most widespread communities in the additional biodiversity offset area. Ironbark Woodland Complex occurs predominantly in the north-west, as does the small occurrence of Forest Red Gum Riparian Woodland. The Improved Pasture is adjacent to the southern boundary of the property.

### 6.3.3.2 Flora Species

A total of 153 flora species were recorded within the additional biodiversity offset area, of which 135 (88 per cent) are native and 18 (12 per cent) are introduced species. A full list of the flora species recorded during survey of the additional biodiversity offset area is presented in Table 2 of **Appendix A**.

One species was from the Class Coniferopsida (conifers), two species were from the Class Filicopsida (ferns), and 150 from Magnoliopsida (flowering plants) (of which 47 were from sub-class Liliidae (monocots) and 103 from sub-class Magnoliidae (dicots)). Flora species were recorded from 42 plant families, the most speciose being Poaceae (39 species), Asteraceae (20 species) Fabaceae (14 species) and Myrtaceae (9 species).

### 6.3.3.3 Threatened Flora Species and Endangered Flora Populations

#### Weeping Myall (*Acacia pendula*)

Weeping myall (*Acacia pendula*) in the Hunter Valley, listed as an endangered population in the Hunter Valley, was recorded in five locations in the additional biodiversity offset area (refer to **Figure 6.2**).

The weeping myall recorded in the additional biodiversity offset area are mostly regenerating individuals, present in small discrete patches, within the Slaty Box Woodland or Modified Native Grassland communities. The Hunter Valley Weeping Myall Woodland EEC, listed under the TSC Act, is therefore not considered to be present as the weeping myall does not form a woodland community and the species typically associated with this EEC are not present.

#### Lobed bluegrass (*Bothriochloa biloba*)

Lobed bluegrass (*Bothriochloa biloba*) is listed as vulnerable under the EPBC Act. It was previously listed under the TSC Act, however it has been de-listed due to an increasing abundance of records. This threatened grass species has been recorded in high abundance in the additional biodiversity offset area (**Figure 6.2**). Based on observations of this species for previous studies, it is considered likely that the majority of grassland habitats within the additional biodiversity offset area would support *Bothriochloa biloba* in varying densities.

### 6.3.3.4 Fauna Habitat

Two terrestrial fauna habitat formations occur within the additional biodiversity offset area, these aligning with the mapped vegetation communities (**Figure 6.2**), being Woodland and Grassland. The additional biodiversity offset area contains approximately 165.3 hectares of Woodland habitat and 164.2 hectares of Grassland habitat. Each of the habitat formations is reasonably widespread within the locality.

The Woodland habitat is dominated by Ironbark Woodland Complex and Slaty Box Woodland. The structure of this habitat type is characterised by a medium to low canopy height (to 17 metres) with less than 20 per cent canopy cover. The blossoming *Eucalyptus* spp. and *Angophora floribunda* provide foraging resources for nectarivorous and insectivorous species, including threatened mammals such as the squirrel glider (*Petaurus norfolcensis*) and threatened woodland birds such as the brown treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*) and diamond firetail (*Stagonopleura guttata*). Scattered mature hollow-bearing trees provide potential nesting resources for large arboreal mammal, owls, micro-bats and other hollow dependent fauna. Approximately five hollows per hectare were identified within this habitat type in the additional biodiversity offset area.

The understorey stratum in the Woodland habitat is generally open and therefore provides potential foraging habitat for micro-bats, macropods and woodland birds. A moderate density of log and rock cover occurs throughout the area, which provides cover for small mammal, reptile and amphibian species. Several small farm dams occur throughout the additional biodiversity offset area and two ephemeral creeks are likely to provide occasional water resources. These water resources support common amphibian species such as the smooth toadlet (*Uperoleia laevis*) and broad-palmed frog (*Litoria latopalmata*), and provide a freshwater drinking resource for a wide range of fauna species. Exposed rocks occur in the north-west of the additional biodiversity offset area providing foraging and refuge habitat for reptile and small mammal species.

The Grassland habitat consists of an open pasture area, highly disturbed from grazing over many years. This habitat occurs mostly along the northern, eastern and southern boundaries of the additional biodiversity offset area. The structure of this habitat is characterised by open grassy areas with scattered isolated trees (to 20 metres) comprising species from adjacent vegetation communities. The scattered trees provide several large and small hollows providing potential nesting resources for arboreal mammals, micro-bats and a range of bird species including large forest owls. The ground cover is dense, dominated by native grasses and forbs, and a large number of fallen logs occur, providing foraging and refuge for small mammal, reptile and amphibian species. Exposed rocks occur in the north-west of the additional biodiversity offset area providing foraging and refuge habitat for reptile and small mammal species.

#### 6.3.3.5 Fauna Species

A total of 83 fauna species were identified in the additional biodiversity offset area during the field surveys, including 54 bird, six reptile, two amphibian and 21 mammal species; a complete list of these species is provided in Table 2 of **Appendix B**.

Of the 54 bird species recorded during the surveys, four species are listed as Vulnerable under the TSC Act, six species listed as Migratory under the EPBC Act and six species listed as Marine/Migratory under the EPBC Act. The identified TSC Act listed Vulnerable species included the little lorikeet (*Glossopsitta pusilla*), brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) and diamond firetail (*Stagonopleura guttata*). One introduced bird species was also identified in the additional biodiversity offset area, being the common myna (*Sturnus tristis*).

Six species of reptile were identified in the additional biodiversity offset area during surveys including the thick-tailed gecko (*Underwoodisaurus milii*), striped skink (*Ctenotus robustus*), *Egernia modesta*, tree-skink (*Egernia striolata*), garden skink (*Lampropholis guichenoti*) and weasel skink (*Saproscincus musteline*). The most commonly identified reptile species was *Egernia modesta*. None of these species are listed as threatened under either the TSC Act or EPBC Act.

Two amphibian species were identified within the additional biodiversity offset area, being the smooth toadlet (*Uperoleia laevis*) and broad-palmed frog (*Litoria latopalmata*). Both of these species were commonly heard calling during spotlighting. Neither species is listed under the TSC Act or EPBC Act.

A total of 21 mammal species were identified within the additional biodiversity offset area during surveys. Terrestrial mammals included the eastern grey kangaroo (*Macropus giganteus*), common brushtail possum (*Trichosurus vulpecula*) and red-necked wallaby (*Macropus rufogriseus*). Sixteen micro-bat species were also recorded. Four threatened mammal species (all micro-bats) were identified, being the eastern freetail-bat (*Mormopterus norfolkensis*), large-eared pied bat (*Chalinolobus dwyeri*), eastern cave bat (*Vespadelus*

*troughtoni*) and eastern bentwing-bat (*Miniopterus schreibersii oceanensis*). These species are listed as Vulnerable under the TSC Act, with the large-eared pied bat (*Chalinolobus dwyeri*) also listed as Vulnerable under the EPBC Act. Two introduced mammal species were identified in the additional biodiversity offset area, these were the fox (*Vulpes vulpes*) and brown hare (*Lepus capensis*).

#### **6.3.3.6 Threatened Fauna Species**

The following threatened fauna species were recorded within the additional biodiversity offset area, as a result of field surveys completed for the current project:

- little lorikeet (*Glossopsitta pusilla*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- diamond firetail (*Stagonopleura guttata*);
- eastern freetail-bat (*Mormopterus norfolkensis*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- eastern cave bat (*Vespadelus trougtoni*); and
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

#### **6.3.3.7 Key Ecological Components of the Additional Biodiversity Offset Area**

When combined with the offsetting proposed for the 500 kV transmission line project, the Additional Biodiversity Offset Area totals 64 hectares, containing the following significant ecological features:

- 21.0 hectares of the Ironbark Woodland Complex (consistent with Central Hunter Grey Box – Ironbark Woodland EEC);
- 30.7 hectares of Slaty Box Woodland (consistent with Hunter Valley Footslopes Slaty Gum Woodland VEC);
- 1.2 hectares of Forest Red Gum Riparian Woodland;
- records of eastern cave bat (*Vespadelus trougtoni*);
- records of eastern freetail-bat (*Mormopterus norfolkensis*);
- records of eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- records of large-eared pied bat (*Chalinolobus dwyeri*);
- records of the brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*); and
- records of the diamond firetail (*Stagonopleura guttata*).

When combined, these records contribute to the ecological value of this area, and highlight the suitability of it as an offset area for the impacts of the proposed modification and ETL relocation projects.

Apart from the above ecological features of this offset area, it provides valuable corridor function within a generally fragmented landscape. The additional biodiversity offset area is primarily vegetated, and its protection will ensure existing vegetated connectivity from the heavily vegetated existing Conservation Offset Area in the north to the vegetated habitats of the Myambat Military Area. This will provide additional security to the existing corridor function of this area, which will assist in preserving movement corridors for flora and fauna in the local area. This improved security will, in turn assist in securing this connectivity on a regional basis.

### 6.3.4 Ecological Management

A number of general management strategies will be employed across the additional biodiversity offset area to ensure the future ecological integrity of the property. These include the following:

- **Removal of Stock** – Grazing will cease in the offset area upon establishment, apart from specific cases where short term strategic grazing (under specific ecological requirements and strict management via the Draft ROMP) is deemed appropriate for the control of undesirable pasture species in the grassland community. Such strategic grazing would only occur in specific short-term periods, and would be heavily regulated. The general exclusion of stock will remove existing pressures on the offset areas, and is likely to encourage natural regeneration of native species from the seed bank, and migration of vegetation from adjoining vegetated areas.

It is not practicable to remove grazing impacts from native fauna species such as macropods in these areas. However grazing from native animals generally has a much lower impact on native vegetation.

- **Fencing/Access Control** – fencing will be used to ensure that the additional biodiversity offset area is appropriately protected from impacts such as grazing, damage to vegetation from vehicles or trampling, increased rubbish dumping and alteration to normal fauna behaviour patterns due to human presence. Any fencing will use non-barbed (plain) wire only, as these areas are to be managed specifically for ecological purposes. The exclusion of barbed wire from fencing will minimise potential injury or death of fauna species, particularly macropods and gliding or flying mammals, such as the squirrel glider (*Petaurus norfolcensis*) and threatened micro-bats. Fencing design will also consider the use of as few wire strands as practical to reduce potential for macropod entanglement. Appropriate signage will be used throughout the area to identify the purpose of the area and also to identify areas of high ecological significance.
- **Weed and Feral Animal Control** – The presence of weed and feral animal species has the potential to significantly decrease the value of this offset area to native species, particularly threatened species. Weed and feral animal management controls will be incorporated into the management of this offset area, to detail the types of species known to be present and required control methods and frequencies. Weeds and feral animals will be monitored on a regular basis to ensure infestations do not decrease the ecological integrity of this offset area.

### 6.3.5 Monitoring

The additional biodiversity offset area will be subject to annual monitoring and maintenance actions, to document the ecological integrity of the area. The monitoring will focus on the most appropriate indicators and methods that:

- provide a good indication of the status of the environmental value that the offset area aims to protect;
- are relatively simple to measure and are reproducible; and
- are cost effective.

Monitoring events will identify any maintenance actions required, whether assistance is required to achieve target native vegetation communities, and will target issues such as fence condition, progression of regeneration and the need for targeted weeding.

Monitoring works to be completed within the additional biodiversity offset area will be of a comparable type, frequency and effort to those that are being undertaken within the Biodiversity Offset Areas for the Mangoola Coal Project, as defined within the Draft ROMP (Umwelt, in prep.). Baseline data will be collected as soon as the offset area is established, to ensure an appropriate benchmark is set from which to compare the ongoing ecological condition.

## 6.4 Performance Against DECCW Offsetting Principles

This section provides a comparison of the performance of the impact mitigation and biodiversity offsetting measures proposed as part of the Project against the principles for biodiversity offsetting (DECCW 2008).

- **Impacts must be avoided first by using prevention and mitigation measures**

The project has been designed in a manner that creates as little disturbance to the ecological features of the Biodiversity Offset Areas as possible, whilst maintaining the economic feasibility and practicality of the project. Redesign of one of the Proposed Modification Areas has resulted in the avoidance of a substantial sub-population (at least 120 individuals) of tricolour diuris (*Diuris tricolor*). Where impact on ecological features has been unavoidable, robust Impact Mitigation and Biodiversity Offset strategies have been provided to address mitigation of residual impacts in the long term.

- **All regulatory requirements must be met**

The Impact Mitigation and Biodiversity Offset strategies for this project have been developed in accordance with the offsetting regulatory requirements, particularly the requirements of the Director-General of the Department of Planning (which includes consideration of the issues of concern of all other relevant regulatory authorities).

- **Offsets must never reward ongoing poor performance**

Xstrata has a long history of ecological management and monitoring within its holdings, which include a number of large mines that have been operating for many years. All ecological management and monitoring within the Biodiversity Offset Areas is subject to detailed requirements of the existing Project Approval including the ROMP, and will be subject to regular review as part of the audit process established by the current Project Approval.

- **Offsets will complement other government programs**

The proposed Impact Mitigation and Biodiversity Offset strategies do not contradict any government programs relevant to the local area, nor do they impact on national parks, nature reserves, state conservation areas or state forests in the area. The Impact Mitigation and Biodiversity Offset strategies will complement the existing ecological management and monitoring requirements for Mangoola Coal, and these will be documented within the ROMP (Umwelt, in prep.), required by the current Project Approval.

- **Offsets must be underpinned by sound ecological principles**

The Impact Mitigation and Biodiversity Offset strategies have been developed with the aim to maintain or improve the biodiversity values of the area. To achieve this, a variety of actions/strategies will be employed to address specific impacts of the project. Such actions and strategies are commonly employed in projects of this type, and are well tested and accepted in relation to their ability to address impacts. The additional biodiversity offset area has been selected due to its existing ecological features (that are similar to those within the Proposed Modification Areas) as well as its vegetated contiguity with the existing Conservation Offset Area for the Mangoola Coal Project and other adjoining areas. This positioning of the offset will provide the area within protected vegetation that connects through the western portion of the Mangoola Coal Project area, through the additional biodiversity offset area and south into the protected habitats of the Myambat Military Area.

- **Offsets should aim to result in a net improvement in biodiversity over time**

The proposed Impact Mitigation and Biodiversity Offset Strategies have been developed with the aim to improve the biodiversity values of the area. With the various impact mitigation strategies to be employed as part of the project, it is likely that such an improvement will occur. This will primarily be as a result of the long-term protection of at least 34 hectares of native vegetation (plus the 30 hectares proposed for the 500 kV relocation project), the natural regeneration of disturbed vegetation within the offset area and long-term ecological management and monitoring of the area.

- **Offsets must be enduring and they must offset the impact of the development for the period that the impact occurs**

The proposed Impact Mitigation and Biodiversity Offset commitments for this project will occur over the long-term (that is beyond the life of the mine), until such time that the commitments have been achieved, completion criteria have been met and sign-off has occurred.

The additional biodiversity offset area will be secured for long-term conservation. The mechanism for securing this conservation will be determined in consultation with DoP and DECCW, in accordance with the current Project Approval schedule 3, condition 40.

- **Offsets should be agreed prior to the impact occurring**

The proposed Impact Mitigation and Biodiversity Offset strategies contained within this Ecological Assessment represent the entire suite of actions that will be employed in order to reduce the impact of the project on ecological features. The ROMP for the Mangoola Coal Project further defines the commitments within this document, and addresses any additional issues that arise as part of the review and approvals process. The ROMP has been submitted to the relevant authorities for approval, in accordance with the current Project Approval conditions.

The Impact Mitigation and Biodiversity Offset strategies allow for the up-front protection of the additional biodiversity offset area, to provide immediate compensation for loss of habitat from the Proposed Modification Areas.

Clearing of vegetation within the Proposed Modification Areas will occur progressively, which will help to ensure the impact from loss of vegetation is minimised. Similarly, the return of hollows (via nest boxes or salvaged hollows) will occur within no more than three months of their initial removal, to ensure breeding opportunities are not lost as a result of loss of habitat.

- **Offsets must be quantifiable and the impacts and benefits must be reliably estimated**

The Impact Mitigation and Biodiversity Offset Strategies have been developed through detailed consideration of known impacts on known records of threatened species, endangered populations and TECs (including their habitats), which have been identified and discussed in **Section 4.0**. The planning of the additional biodiversity offset area took into account such identified impacts, and identified preferences based on the ability of such available areas to appropriately address such impacts.

The area of impact has been derived from detailed mapping of project boundaries and impact areas, and the ecological survey, mapping and impact assessments have been completed by qualified ecologists with considerable experience in the region.

- **Offsets must be targeted**

The development of the Impact Mitigation and Biodiversity Offset Strategies has been based on addressing the identified ecological impacts of the project (see **Section 4.0**). These impacts have been identified via a thorough survey and assessment process, which has been described in detail within this document. Following this identification of impact, the Impact Mitigation and Biodiversity Offset Strategies have been designed to provide mitigation actions targeted at each of the major impacts.

- **Offsets must be located appropriately**

The additional biodiversity offset area is located on land that is wholly owned by Xstrata Mangoola, adjoins the existing Conservation Offset Area for the Mangoola Coal Project and is located such as to contribute to enhanced corridor values. The vegetation and habitats represented within this offset area are representative of the vegetation types and habitats that will be lost within the Proposed Modification Areas.

- **Offsets must be supplementary**

The additional biodiversity offset area is being proposed in addition to the existing extensive Biodiversity Offset Areas that have been put forward as part of the Mangoola Coal Project. Thirty hectares of this property are proposed to offset impacts from the proposed 500 kV relocation project, and an additional 34 hectares is proposed to offset impacts from the current modification project. There are currently no existing conservation-based commitments on this area.

- **Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or a contract.**

As the Impact Mitigation and Biodiversity Offset Strategies are being proposed as an integral component of this project, it is expected that the commitments in these strategies will be included within the project approval conditions as they form part of the Statement of Commitments for the Environmental Assessment for the project.

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### **Personal Communications**

- Rush, M. (Cr) (2009). Mayor, Muswellbrook Shire Council.

# **APPENDIX A**

## **Flora Species List**

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## Appendix A – Flora Species List

**Table 1** of this appendix consists of all flora species recorded within the Anvil Hill Project EA study area completed by Umwelt in 2006. This list has been used to provide information on the floristics of the local area, as detailed quantitative flora surveys of the Proposed Modification Areas was not completed. This was due to the small size of these areas and the existing knowledge of their ecological features. Field survey of these Proposed Modification Areas was completed to ground-truth the existing vegetation and to complete updated searches for threatened flora species (see Section 2.2 of the main report).

**Table 2** of this appendix consists of all flora species recorded within the additional biodiversity offset area, during surveys completed in February 2010 (see Section 6.3.2 of the main report). These surveys were completed across the whole property to allow informed selection of appropriate areas to offset the residual impacts of the Proposed Modification Areas.

These lists include all species of vascular plants observed during fieldwork completed at the time. Due to issues of detectability, the list will not necessarily include all plant species likely to occur. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) system.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

|       |                                                                                   |
|-------|-----------------------------------------------------------------------------------|
| sp.   | specimens that are identified to genus level only;                                |
| ?     | specimens for which identification was uncertain;                                 |
| prob. | specimens for which identification was considered highly likely but not definite; |
| poss. | specimens for which identification was considered likely but not definite;        |

The following abbreviations or symbols are used in the list:

|              |                                                   |
|--------------|---------------------------------------------------|
| asterisk (*) | denotes species not indigenous to the study area; |
| subsp.       | subspecies;                                       |
| var.         | variety;                                          |
| f.           | forma; and                                        |
| X            | hybrid.                                           |

Threatened species or endangered populations are indicated in **bold** type.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2010), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

**Table1 – Flora Species Recorded from Anvil Hill Project EA (Umwelt 2006)**

| Family                                                        | Scientific Name                                  | Common Name            |
|---------------------------------------------------------------|--------------------------------------------------|------------------------|
| <b>Coniferopsida (Conifers)</b>                               |                                                  |                        |
| Cupressaceae                                                  | <i>Callitris endlicheri</i>                      | black cypress pine     |
| <b>Filicopsida (Ferns)</b>                                    |                                                  |                        |
| Adiantaceae                                                   | <i>Adiantum aethiopicum</i>                      | common maidenhair      |
| Adiantaceae                                                   | <i>Cheilanthes austrotenuifolia</i>              | rock fern              |
| Adiantaceae                                                   | <i>Cheilanthes distans</i>                       | bristly cloak fern     |
| Adiantaceae                                                   | <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> | poison rock fern       |
| Adiantaceae                                                   | <i>Pellaea falcate</i>                           | sickle fern            |
| Adiantaceae                                                   | <i>Pellaea nana</i>                              | sickle fern            |
| Aspleniaceae                                                  | <i>Asplenium flabellifolium</i>                  | necklace fern          |
| Davalliaceae                                                  | * <i>Nerium oleander</i>                         | oleander               |
| Azollaceae                                                    | <i>Azolla</i> sp.                                |                        |
| Dennstaedtiaceae                                              | <i>Histiopteris incisa</i>                       | bats wing fern         |
| Dennstaedtiaceae                                              | <i>Pteridium esculentum</i>                      | bracken                |
| Marsileaceae                                                  | <i>Marsilea drummondii</i>                       | common nardoo          |
| <b>Cycadopsida (Cycads)</b>                                   |                                                  |                        |
| Zamiaceae                                                     | <i>Macrozamia communis</i>                       | burrawang              |
| Zamiaceae                                                     | <i>Macrozamia plurinervia</i>                    | burrawang              |
| Zamiaceae                                                     | <i>Macrozamia reducta</i>                        |                        |
| Zamiaceae                                                     | <i>Macrozamia spiralis</i>                       | burrawang              |
| <b>Magnoliopsida (flowering plants) - Liliidae (monocots)</b> |                                                  |                        |
| Anthericaceae                                                 | <i>Arthropodium milleflorum</i>                  | vanilla lily           |
| Anthericaceae                                                 | <i>Arthropodium</i> species B                    | a vanilla lily         |
| Anthericaceae                                                 | <i>Caesia parviflora</i>                         | pale grass-lily        |
| Anthericaceae                                                 | <i>Caesia</i> sp.                                |                        |
| Anthericaceae                                                 | <i>Dichopogon fimbriatus</i>                     | nodding chocolate lily |
| Anthericaceae                                                 | <i>Dichopogon strictus</i>                       | chocolate lily         |
| Anthericaceae                                                 | <i>Laxmannia compacta</i>                        |                        |
| Anthericaceae                                                 | <i>Laxmannia gracilis</i>                        | slender wire lily      |
| Anthericaceae                                                 | <i>Thysanotus tuberosus</i>                      | common fringe-lily     |
| Anthericaceae                                                 | <i>Tricoryne elatior</i>                         | yellow autumn-lily     |
| Asparagaceae                                                  | * <i>Asparagus asparagoides</i>                  | bridal creeper         |
| Asphodelaceae                                                 | * <i>Asphodelus fistulosus</i>                   | onion weed             |
| Asphodelaceae                                                 | <i>Bulbine semibarbata</i>                       | native leek            |
| Colchicaceae                                                  | <i>Wurmbea biglandulosa</i>                      | early Nancy            |
| Colchicaceae                                                  | <i>Wurmbea dioica</i> subsp. <i>dioica</i>       | early Nancy            |
| Colchicaceae                                                  | <i>Wurmbea</i> sp.                               |                        |
| Commelinaceae                                                 | <i>Commelina cyanea</i>                          | native wandering Jew   |
| Commelinaceae                                                 | <i>Murdannia graminea</i>                        | murdannia              |
| Cyperaceae                                                    | <i>Carex appressa</i>                            | tall sedge             |
| Cyperaceae                                                    | <i>Carex breviculmis</i>                         | short-stem sedge       |
| Cyperaceae                                                    | <i>Carex incomitata</i>                          |                        |
| Cyperaceae                                                    | <i>Carex inversa</i>                             | knob sedge             |
| Cyperaceae                                                    | <i>Cyperus difformis</i>                         |                        |

| Family           | Scientific Name                                     | Common Name            |
|------------------|-----------------------------------------------------|------------------------|
| Cyperaceae       | <i>Cyperus enervis</i>                              |                        |
| Cyperaceae       | <i>Cyperus fulvus</i>                               | sticky sedge           |
| Cyperaceae       | <i>Cyperus gracilis</i>                             |                        |
| Cyperaceae       | <i>Cyperus laevis</i>                               |                        |
| Cyperaceae       | <i>Cyperus polystachyos</i>                         |                        |
| Cyperaceae       | <i>Cyperus sanguinolentus</i>                       |                        |
| Cyperaceae       | <i>Cyperus</i> sp.                                  |                        |
| Cyperaceae       | <i>Eleocharis cylindrostachys</i>                   |                        |
| Cyperaceae       | <i>Eleocharis plana</i>                             | flat spike-sedge       |
| Cyperaceae       | <i>Fimbristylis dichotoma</i>                       | common fringe-sedge    |
| Cyperaceae       | <i>Gahnia aspera</i>                                | rough saw-sedge        |
| Cyperaceae       | <i>Lepidosperma laterale</i>                        |                        |
| Cyperaceae       | <i>Scleria mackaviensis</i>                         |                        |
| Cyperaceae       | <i>Schoenus apogon</i>                              | fluke bogrush          |
| Iridaceae        | * <i>Romulea rosea</i>                              | onion grass            |
| Hydrocharitaceae | <i>Ottelia ovalifolia</i>                           | swamp lily             |
| Hypoxidaceae     | <i>Hypoxis pratensis</i> var. <i>pratensis</i>      |                        |
| Juncaceae        | * <i>Juncus acutus</i>                              | sharp rush             |
| Juncaceae        | * <i>Juncus acutus</i> subsp. <i>acutus</i>         |                        |
| Juncaceae        | <i>Juncus mollis</i>                                |                        |
| Juncaceae        | <i>Juncus</i> sp.                                   |                        |
| Juncaceae        | <i>Juncus filicaulis</i>                            |                        |
| Juncaceae        | <i>Juncus homalocaulis</i>                          |                        |
| Juncaceae        | <i>Juncus subsecundus</i>                           |                        |
| Juncaceae        | <i>Juncus subsecundus</i> — <i>remotiflorus</i>     |                        |
| Juncaceae        | <i>Juncus usitatus</i>                              |                        |
| Juncaceae        | <i>Luzula flaccida</i>                              |                        |
| Juncaginaceae    | <i>Triglochin procerum</i>                          | water ribbons          |
| Juncaginaceae    | <i>Triglochin striatum</i>                          | streaked arrow grass   |
| Lomandraceae     | <i>Lomandra confertifolia</i>                       | mat rush               |
| Lomandraceae     | <i>Lomandra confertifolia</i> subsp. <i>pallida</i> |                        |
| Lomandraceae     | <i>Lomandra filiformis</i>                          |                        |
| Lomandraceae     | <i>Lomandra filiformis</i> subsp. <i>coriacea</i>   |                        |
| Lomandraceae     | <i>Lomandra filiformis</i> subsp. <i>filiformis</i> | wattle mat rush        |
| Lomandraceae     | <i>Lomandra glauca</i>                              | pale mat-rush          |
| Lomandraceae     | <i>Lomandra longifolia</i>                          | spiny-headed mat-rush  |
| Lomandraceae     | <i>Lomandra multiflora</i>                          | many-flowered mat-rush |
| Lomandraceae     | <i>Lomandra multiflora</i> subsp. <i>multiflora</i> | many-flowered mat-rush |
| Luzuriagaceae    | <i>Eustrephus latifolius</i>                        | wombat berry           |
| Orchidaceae      | <i>Acianthus</i> sp.                                |                        |
| Orchidaceae      | <i>Caladenia caerulea</i>                           | blue caladenia         |
| Orchidaceae      | <i>Caladenia carnea</i> var. <i>carnea</i>          | pink fairy             |

| Family             | Scientific Name                                         | Common Name             |
|--------------------|---------------------------------------------------------|-------------------------|
| Orchidaceae        | <i>Caladenia catenata</i>                               | white caladenia         |
| <b>Orchidaceae</b> | <b><i>Cymbidium canaliculatum</i></b>                   | <b>tiger orchid</b>     |
| <b>Orchidaceae</b> | <b><i>Diuris tricolor</i></b>                           | <b>tricolour diuris</b> |
| Orchidaceae        | <i>Eriochilus cucullatus</i>                            | parsons bands           |
| Orchidaceae        | <i>Glossodia major</i>                                  | waxlip orchid           |
| Orchidaceae        | <i>Microtis parviflora</i>                              | slender onion orchid    |
| Orchidaceae        | <i>Microtis unifolia</i>                                | common onion orchid     |
| Orchidaceae        | <i>Pterostylis bicolor</i>                              |                         |
| Orchidaceae        | <i>Pterostylis curta</i>                                | blunt greenhood         |
| Orchidaceae        | <i>Pterostylis cycnocephala</i>                         | swan greenhood          |
| Orchidaceae        | <i>Pterostylis reflexa</i>                              |                         |
| Orchidaceae        | <i>Thysanotus</i> sp.                                   |                         |
| Phormiaceae        | <i>Dianella caerulea</i> var. <i>caerulea</i>           | blue-flax lily          |
| Phormiaceae        | <i>Dianella longifolia</i>                              | blue flax lily          |
| Phormiaceae        | <i>Dianella revoluta</i>                                | blue flax lily          |
| Phormiaceae        | <i>Dianella</i> sp.                                     |                         |
| Phormiaceae        | <i>Stypandra glauca</i>                                 | nodding blue lily       |
| Poaceae            | <i>Agrostis</i> sp.                                     | bent grass              |
| Poaceae            | * <i>Aira cupaniana</i>                                 | silvery hairgrass       |
| Poaceae            | <i>Ancistrachne uncinulata</i>                          | hooky grass             |
| Poaceae            | <i>Aristida acuta</i>                                   |                         |
| Poaceae            | <i>Aristida benthamii</i> var. <i>benthamii</i>         |                         |
| Poaceae            | <i>Aristida blakei</i>                                  |                         |
| Poaceae            | <i>Aristida calycina</i> var. <i>calycina</i>           | dark wiregrass          |
| Poaceae            | <i>Aristida calycina</i> var. <i>praealta</i>           | dark wiregrass          |
| Poaceae            | <i>Aristida echinata</i>                                |                         |
| Poaceae            | <i>Aristida jerichoensis</i> var. <i>jerichoensis</i>   | Jericho wiregrass       |
| Poaceae            | <i>Aristida leichhardtiana</i>                          |                         |
| Poaceae            | <i>Aristida personata</i>                               |                         |
| Poaceae            | <i>Aristida queenslandica</i> var. <i>queenslandica</i> |                         |
| Poaceae            | <i>Aristida ramosa</i>                                  | purple wiregrass        |
| Poaceae            | <i>Aristida ramosa</i> var. <i>scaberula</i>            | wiregrass               |
| Poaceae            | <i>Aristida ramosa</i> var. <i>speciosa</i>             |                         |
| Poaceae            | <i>Aristida</i> sp.                                     |                         |
| Poaceae            | <i>Aristida vagans</i>                                  | threeawn speargrass     |
| Poaceae            | <i>Austrodanthonia bipartita</i>                        | wallaby grass           |
| Poaceae            | <i>Austrodanthonia caespitosa</i>                       | ringed wallaby grass    |
| Poaceae            | <i>Austrodanthonia fulva</i>                            | wallaby grass           |
| Poaceae            | <i>Austrodanthonia monticola</i>                        |                         |
| Poaceae            | <i>Austrodanthonia racemosa</i> var. <i>obtusata</i>    | white top               |
| Poaceae            | <i>Austrodanthonia racemosa</i> var. <i>racemosa</i>    | white top               |
| Poaceae            | <i>Austrodanthonia richardsonii</i>                     | straw wallaby-grass     |
| Poaceae            | <i>Austrodanthonia</i> sp.                              |                         |

| Family         | Scientific Name                                    | Common Name                 |
|----------------|----------------------------------------------------|-----------------------------|
| Poaceae        | <i>Austrodanthonia tenuior</i>                     |                             |
| Poaceae        | <i>Austrostipa ?aristiglumis</i>                   | plains grass                |
| Poaceae        | <i>Austrostipa nodosa</i>                          |                             |
| Poaceae        | <i>Austrostipa scabra</i> subsp. <i>scabra</i>     | speargrass                  |
| Poaceae        | <i>Austrostipa ramosissima</i>                     | stout bamboo grass          |
| Poaceae        | <i>Austrostipa scabra</i> subsp. <i>falcata</i>    | speargrass                  |
| Poaceae        | <i>Austrostipa scabra</i> subsp. <i>scabra</i>     | corkscrew grass             |
| Poaceae        | <i>Austrostipa setacea</i>                         | corkscrew grass             |
| Poaceae        | <i>Austrostipa</i> sp.                             |                             |
| Poaceae        | <i>Austrostipa verticillata</i>                    | slender bamboo grass        |
| Poaceae        | * <i>Avena fatua</i>                               | wild oats                   |
| Poaceae        | * <i>Avena sativa</i>                              | oats                        |
| <b>Poaceae</b> | <b><i>Bothriochloa biloba</i></b>                  | <b>lobed blue-grass</b>     |
| Poaceae        | <i>Bothriochloa decipiens</i>                      | red grass                   |
| Poaceae        | <i>Bothriochloa macra</i>                          | red grass                   |
| Poaceae        | <i>Bothriochloa</i> sp.                            |                             |
| Poaceae        | * <i>Briza minor</i>                               | shivery grass               |
| Poaceae        | * <i>Bromus catharticus</i>                        | prairie grass               |
| Poaceae        | * <i>Bromus hordeaceus</i>                         |                             |
| Poaceae        | * <i>Bromus molliformis</i>                        | soft brome                  |
| Poaceae        | <i>Cenchrus caliculatus</i>                        | hillside burrgrass          |
| Poaceae        | <i>Chloris divaricata</i>                          |                             |
| Poaceae        | <i>Chloris divaricata</i> var. <i>divaricata</i>   | slender chloris             |
| Poaceae        | * <i>Chloris gayana</i>                            | Rhodes grass                |
| Poaceae        | <i>Chloris</i> sp.                                 |                             |
| Poaceae        | <i>Chloris truncata</i>                            | windmill grass              |
| Poaceae        | <i>Chloris ventricosa</i>                          | tall chloris                |
| Poaceae        | <i>Cleistochloa rigida</i>                         |                             |
| Poaceae        | <i>Cymbopogon refractus</i>                        | barbed wire grass           |
| Poaceae        | <i>Cynodon dactylon</i>                            | common couch                |
| Poaceae        | * <i>Dactylis glomerata</i>                        | cocksfoot                   |
| Poaceae        | <i>Dichanthium sericeum</i>                        | Queensland bluegrass        |
| Poaceae        | <i>Dichanthium sericeum</i> subsp. <i>sericeum</i> | Queensland bluegrass        |
| Poaceae        | <i>Dichelachne crinita</i>                         | longhair plumegrass         |
| Poaceae        | <i>Dichelachne micrantha</i>                       | shorthair plumegrass        |
| Poaceae        | <i>Digitaria breviglumis</i>                       |                             |
| Poaceae        | <i>Digitaria brownii</i>                           | cotton panic grass          |
| Poaceae        | <i>Digitaria diffusa</i>                           |                             |
| Poaceae        | <i>Digitaria divaricatissima</i>                   | umbrella grass              |
| Poaceae        | <i>Digitaria parviflora</i>                        | small-flowered finger grass |
| Poaceae        | <i>Digitaria ramularis</i>                         |                             |
| Poaceae        | <i>Digitaria</i> sp.                               |                             |
| Poaceae        | <i>Echinopogon caespitosus</i>                     | bushy hedgehog-grass        |
| Poaceae        | <i>Echinopogon ovatus</i>                          | forest hedgehog grass       |
| Poaceae        | * <i>Ehrharta erecta</i>                           | panic veldtgrass            |

| Family  | Scientific Name                                   | Common Name             |
|---------|---------------------------------------------------|-------------------------|
| Poaceae | <i>*Eleusine tristachya</i>                       | goose grass             |
| Poaceae | <i>Elymus scaber</i> var. <i>scaber</i>           | common wheatgrass       |
| Poaceae | <i>Enneapogon gracilis</i>                        | slender nineawn         |
| Poaceae | <i>Enteropogon acicularis</i>                     |                         |
| Poaceae | <i>Entolasia marginata</i>                        | bordered panic          |
| Poaceae | <i>Entolasia</i> sp.                              | Poaceae                 |
| Poaceae | <i>Entolasia stricta</i>                          | wiry panic              |
| Poaceae | <i>Eragrostis alveiformis</i>                     |                         |
| Poaceae | <i>Eragrostis benthamii</i>                       |                         |
| Poaceae | <i>Eragrostis brownii</i>                         | Browns lovegrass        |
| Poaceae | <i>*Eragrostis cilianensis</i>                    | stinkgrass              |
| Poaceae | <i>Eragrostis falcata</i>                         | sickle lovegrass        |
| Poaceae | <i>Eragrostis lacunaria</i>                       | purple lovegrass        |
| Poaceae | <i>Eragrostis leptostachya</i>                    | paddock lovegrass       |
| Poaceae | <i>Eragrostis parviflora</i>                      | weeping lovegrass       |
| Poaceae | <i>Eragrostis</i> sp.                             |                         |
| Poaceae | <i>Eriochloa pseudoacrotricha</i>                 | early spring grass      |
| Poaceae | <i>Eulalia aurea</i>                              | silky browntop          |
| Poaceae | <i>Eulalia fulva</i>                              |                         |
| Poaceae | <i>*Hordeum leporinum</i>                         | barley grass            |
| Poaceae | <i>Imperata cylindrica</i> var. <i>major</i>      | blady grass             |
| Poaceae | <i>Joycea pallida</i>                             | silvertop wallaby grass |
| Poaceae | <i>Lachnagrostis filiformis</i>                   | blown grass             |
| Poaceae | <i>*Lolium loliaceum</i>                          | stiff ryegrass          |
| Poaceae | <i>*Lolium perenne</i>                            | perennial ryegrass      |
| Poaceae | <i>*Lolium rigidum</i>                            | Wimmera ryegrass        |
| Poaceae | <i>Microlaena stipoides</i> var. <i>stipoides</i> | weeping grass           |
| Poaceae | <i>Oplismenus aemulus</i>                         |                         |
| Poaceae | <i>Oplismenus imbecillis</i>                      |                         |
| Poaceae | <i>Panicum effusum</i>                            | poison panic            |
| Poaceae | <i>Panicum queenslandicum</i>                     | Yadbila grass           |
| Poaceae | <i>Panicum simile</i>                             | two-colour panic        |
| Poaceae | <i>Panicum</i> sp.                                |                         |
| Poaceae | <i>Paspalidium albobillosum</i>                   |                         |
| Poaceae | <i>Paspalidium aversum</i>                        | bent summer-grass       |
| Poaceae | <i>Paspalidium caespitosum</i>                    | brigalow grass          |
| Poaceae | <i>Paspalidium constrictum</i>                    | knottybutt grass        |
| Poaceae | <i>Paspalidium distans</i>                        |                         |
| Poaceae | <i>Paspalidium gracile</i>                        | slender panic           |
| Poaceae | <i>*Paspalum dilatatum</i>                        | paspalum                |
| Poaceae | <i>Paspalum distichum</i>                         | saltwater couch         |
| Poaceae | <i>Paspalum</i> sp.                               |                         |
| Poaceae | <i>*Pennisetum clandestinum</i>                   | kikuyu grass            |
| Poaceae | <i>*Pentaschistis airoides</i>                    | false hairgrass         |
| Poaceae | <i>Phragmites australis</i>                       | common reed             |

| Family                                                         | Scientific Name                                             | Common Name               |
|----------------------------------------------------------------|-------------------------------------------------------------|---------------------------|
| Poaceae                                                        | <i>*Phalaris aquatica</i>                                   | phalaris                  |
| Poaceae                                                        | <i>Poa labillardieri</i> var. <i>labillardieri</i>          | tussock                   |
| Poaceae                                                        | <i>Poa</i> sp.                                              |                           |
| Poaceae                                                        | <i>*Setaria gracilis</i>                                    | slender pigeon grass      |
| Poaceae                                                        | <i>Sporobolus caroli</i>                                    | fairy grass               |
| Poaceae                                                        | <i>Sporobolus contiguus</i>                                 |                           |
| Poaceae                                                        | <i>Sporobolus creber</i>                                    | slender rats tail grass   |
| Poaceae                                                        | <i>Sporobolus elongatus</i>                                 | slender rats tail grass   |
| Poaceae                                                        | <i>Themeda australis</i>                                    | kangaroo grass            |
| Poaceae                                                        | <i>*Vulpia muralis</i>                                      |                           |
| Potamogetonaceae                                               | <i>Potamogeton ochreatus</i>                                | blunt pondweed            |
| Typhaceae                                                      | <i>Typha orientalis</i>                                     | broad-leaved cumbungi     |
| Xanthorrhoeaceae                                               | <i>Xanthorrhoea johnsonii</i>                               |                           |
| <b>Magnoliopsida (flowering plants) - Magnoliidae (dicots)</b> |                                                             |                           |
| Acanthaceae                                                    | <i>Brunoniella australis</i>                                | blue trumpet              |
| Acanthaceae                                                    | <i>Brunoniella pumilio</i>                                  | dwarf brunoniella         |
| Acanthaceae                                                    | <i>Rostellularia adscendens</i> subsp. <i>adscendens</i>    | red drums                 |
| Acanthaceae                                                    | <i>Rostellularia adscendens</i> var. <i>pogonantha</i>      |                           |
| Aizoaceae                                                      | <i>*Galenia pubescens</i>                                   | galenia                   |
| Amaranthaceae                                                  | <i>Alternanthera nana</i>                                   | hairy joyweed             |
| Amaranthaceae                                                  | <i>Alternanthera</i> species A                              |                           |
| Amaranthaceae                                                  | <i>*Gomphrena celosioides</i>                               | gomphrena weed            |
| Amaranthaceae                                                  | <i>Ptilotus atriplicifolius</i> var. <i>atriplicifolius</i> |                           |
| Anacardiaceae                                                  | <i>*Schinus areira</i>                                      | pepper tree               |
| Apiaceae                                                       | <i>Actinotus gibbonsii</i>                                  |                           |
| Apiaceae                                                       | <i>*Cyclospermum leptophyllum</i>                           | slender celery            |
| Apiaceae                                                       | <i>Centella asiatica</i>                                    | pennywort                 |
| Apiaceae                                                       | <i>Centella</i> sp.                                         |                           |
| Apiaceae                                                       | <i>*Cyclospermum leptophyllum</i>                           | slender celery            |
| Apiaceae                                                       | <i>Daucus glochidiatus</i>                                  | native carrot             |
| Apiaceae                                                       | <i>Daucus glochidiatus</i> form A                           | native carrot             |
| Apiaceae                                                       | <i>Daucus glochidiatus</i> form F                           | native carrot             |
| Apiaceae                                                       | <i>*Foeniculum vulgare</i>                                  | fennel                    |
| Apiaceae                                                       | <i>*Hydrocotyle bonariensis</i>                             |                           |
| Apiaceae                                                       | <i>Hydrocotyle laxiflora</i>                                | stinking pennywort        |
| Apiaceae                                                       | <i>Platysace ericoides</i>                                  | heath platysace           |
| Apocynaceae                                                    | <i>Marsdenia suaveolens</i>                                 | scented marsdenia         |
| Apocynaceae                                                    | <i>Marsdenia viridiflora</i>                                | native pear               |
| Apocynaceae                                                    | <i>Parsonia eucalyptophylla</i>                             | gargaloo                  |
| Asclepiadaceae                                                 | <i>*Gomphocarpus fruticosus</i>                             | narrow-leaved cotton bush |
| Asclepiadaceae                                                 | <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>      | native pear               |
| Asteraceae                                                     | <i>*Arctotheca calendula</i>                                | capeweed                  |
| Asteraceae                                                     | <i>*Aster subulatus</i>                                     | wild aster                |

| Family     | Scientific Name                                         | Common Name           |
|------------|---------------------------------------------------------|-----------------------|
| Asteraceae | <i>*Bidens pilosa</i>                                   | cobblers pegs         |
| Asteraceae | <i>*Bidens subalternans</i>                             | greater beggars ticks |
| Asteraceae | <i>Brachycome spathulata</i>                            |                       |
| Asteraceae | <i>Brachyscome angustifolia</i>                         |                       |
| Asteraceae | <i>Brachyscome ciliaris</i> var. <i>subintegrifolia</i> | variable daisy        |
| Asteraceae | <i>Brachyscome curvicaarpa</i>                          |                       |
| Asteraceae | <i>Brachyscome multifida</i> var. <i>multifida</i>      | cut-leaved daisy      |
| Asteraceae | <i>Bracteantha bracteata</i>                            | golden everlasting    |
| Asteraceae | <i>Calocephalus citreus</i>                             | lemon beauty-heads    |
| Asteraceae | <i>Calotis cuneifolia</i>                               | purple burr-daisy     |
| Asteraceae | <i>Calotis lappulacea</i>                               | yellow burr-daisy     |
| Asteraceae | <i>Calotis</i> sp.                                      |                       |
| Asteraceae | <i>*Carduus nutans</i> subsp. <i>nutans</i>             | nodding thistle       |
| Asteraceae | <i>*Carthamus lanatus</i>                               | saffron thistle       |
| Asteraceae | <i>Cassinia aculeata</i>                                | dolly bush            |
| Asteraceae | <i>Cassinia arcuata</i>                                 | sifton bush           |
| Asteraceae | <i>Cassinia cunninghamii</i>                            |                       |
| Asteraceae | <i>Cassinia laevis</i>                                  | cough bush            |
| Asteraceae | <i>Cassinia quinquefaria</i>                            |                       |
| Asteraceae | <i>Cassinia</i> species D                               |                       |
| Asteraceae | <i>Cassinia</i> prob. <i>uncata</i>                     | sticky cassinia       |
| Asteraceae | <i>*Centaurea melitensis</i>                            | Maltese cockspur      |
| Asteraceae | <i>Centipeda minima</i> var. <i>minima</i>              | spreading sneezeweed  |
| Asteraceae | <i>*Chondrilla juncea</i>                               | skeleton weed         |
| Asteraceae | <i>Chrysocephalum apiculatum</i>                        | common everlasting    |
| Asteraceae | <i>Chrysocephalum semipapposum</i>                      | clustered everlasting |
| Asteraceae | <i>*Cirsium vulgare</i>                                 | spear thistle         |
| Asteraceae | <i>*Conyza bonariensis</i>                              | flaxleaf fleabane     |
| Asteraceae | <i>*Conyza sumatrensis</i>                              | tall fleabane         |
| Asteraceae | <i>*Conyza</i> sp.                                      |                       |
| Asteraceae | <i>Cotula australis</i>                                 | common cotula         |
| Asteraceae | <i>*Cotula coronopifolia</i>                            | water buttons         |
| Asteraceae | <i>Cymbonotus lawsonianus</i>                           | bears ears            |
| Asteraceae | <i>Cymbonotus</i> sp.                                   | bears ears            |
| Asteraceae | <i>*Dittrichia graveolens</i>                           | stinkwort             |
| Asteraceae | <i>Eclipta platyglossa</i>                              | yellow twin-heads     |
| Asteraceae | <i>Euchiton gymnocephalus</i>                           | creeping cudweed      |
| Asteraceae | <i>Euchiton involucratum</i>                            | cudweed               |
| Asteraceae | <i>Euchiton sphaericus</i>                              | cudweed               |
| Asteraceae | <i>*Facelis retusa</i>                                  |                       |
| Asteraceae | <i>*Gamochaeta americana</i>                            | cudweed               |
| Asteraceae | <i>*Gamochaeta calviceps</i>                            | cudweed               |
| Asteraceae | <i>*Gamochaeta spicata</i>                              | spiked cudweed        |
| Asteraceae | <i>Glossogyne tannensis</i>                             | cobblers tack         |
| Asteraceae | <i>Hedypnois rhagadioloides</i>                         | Cretan weed           |

| Family       | Scientific Name                                               | Common Name              |
|--------------|---------------------------------------------------------------|--------------------------|
| Asteraceae   | <i>Helichrysum scorpioides</i>                                | button everlasting       |
| Asteraceae   | * <i>Hypochaeris radicata</i>                                 | catsear                  |
| Asteraceae   | <i>Lagenifera gracilis</i>                                    | slender lagenophora      |
| Asteraceae   | <i>Lagenifera stipitata</i>                                   | blue bottle-daisy        |
| Asteraceae   | <i>Leptorhynchus panaetioides</i>                             | woolly buttons           |
| Asteraceae   | <i>Olearia elliptica</i>                                      | sticky daisy bush        |
| Asteraceae   | <i>Ozothamnus diosmifolius</i>                                | white dogwood            |
| Asteraceae   | <i>Podolepis neglecta</i>                                     |                          |
| Asteraceae   | <i>Pseuderanthemum variabile</i>                              | pastel flower            |
| Asteraceae   | <i>Pseudognaphalium luteoalbum</i>                            | Jersey cudweed           |
| Asteraceae   | * <i>Schkuhria pinnata</i>                                    |                          |
| Asteraceae   | <i>Senecio hispidulus</i> var. <i>dissectus</i>               | hill fireweed            |
| Asteraceae   | <i>Senecio lautus</i> subsp. <i>dissectifolius</i>            | variable groundsel       |
| Asteraceae   | <i>Senecio quadridentatus</i>                                 | cotton fireweed          |
| Asteraceae   | * <i>Senecio madagascariensis</i>                             | fireweed                 |
| Asteraceae   | <i>Sigesbeckia australiensis</i>                              |                          |
| Asteraceae   | <i>Sigesbeckia orientalis</i>                                 | Indian weed              |
| Asteraceae   | <i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>        | Indian weed              |
| Asteraceae   | * <i>Silybum marianum</i>                                     | variegated thistle       |
| Asteraceae   | <i>Solenogyne belliioides</i>                                 |                          |
| Asteraceae   | * <i>Sonchus oleraceus</i>                                    | common sowthistle        |
| Asteraceae   | * <i>Tagetes minuta</i>                                       | stinking Roger           |
| Asteraceae   | * <i>Taraxacum officinale</i>                                 | dandelion                |
| Asteraceae   | * <i>Tolpis umbellata</i>                                     |                          |
| Asteraceae   | <i>Vernonia cinerea</i>                                       |                          |
| Asteraceae   | <i>Vernonia cinerea</i> var. <i>cinerea</i>                   | fuzzweed                 |
| Asteraceae   | <i>Vittadinia cervicalis</i> var. <i>subcervicalis</i>        |                          |
| Asteraceae   | <i>Vittadinia cuneata</i>                                     | fuzzweed                 |
| Asteraceae   | <i>Vittadinia cuneata</i> var. <i>cuneata</i>                 | fuzzweed                 |
| Asteraceae   | <i>Vittadinia cuneata</i> var. <i>cuneata</i> f. <i>minor</i> | fuzzweed                 |
| Asteraceae   | <i>Vittadinia dissecta</i> var. <i>hirta</i>                  |                          |
| Asteraceae   | <i>Vittadinia muelleri</i>                                    |                          |
| Asteraceae   | <i>Vittadinia pterochaeta</i>                                 | rough fuzzweed           |
| Asteraceae   | <i>Vittadinia pustulata</i>                                   |                          |
| Asteraceae   | <i>Vittadinia</i> sp.                                         |                          |
| Asteraceae   | <i>Vittadinia sulcata</i>                                     |                          |
| Asteraceae   | * <i>Xanthium occidentale</i>                                 | noogoora burr            |
| Asteraceae   | * <i>Xanthium spinosum</i>                                    | Bathurst burr            |
| Asteraceae   | * <i>Xanthium</i> sp.                                         |                          |
| Bignoniaceae | <i>Pandorea pandorana</i> subsp. <i>pandorana</i>             | wonga wonga vine         |
| Boraginaceae | <i>Cynoglossum australe</i>                                   | Australian hounds tongue |
| Boraginaceae | <i>Cynoglossum suaveolens</i>                                 | sweet hounds-tongue      |

| Family          | Scientific Name                                      | Common Name                  |
|-----------------|------------------------------------------------------|------------------------------|
| Boraginaceae    | <i>Halgania brachyrhyncha</i>                        | halgania                     |
| Boraginaceae    | * <i>Echium plantagineum</i>                         | Patersons curse              |
| Brassicaceae    | * <i>Brassica</i> sp.                                |                              |
| Brassicaceae    | * <i>Capsella bursa-pastoris</i>                     |                              |
| Brassicaceae    | * <i>Coronopus didymus</i>                           | lesser swinecress            |
| Brassicaceae    | * <i>Lepidium africanum</i>                          |                              |
| Brassicaceae    | * <i>Lepidium bonariense</i>                         |                              |
| Brassicaceae    | <i>Lepidium pseudohyssopifolium</i>                  |                              |
| Brassicaceae    | <i>Lepidium</i> sp.                                  |                              |
| Brassicaceae    | * <i>Rapistrum rugosum</i>                           | turnip weed                  |
| Brassicaceae    | * <i>Sisymbrium irio</i>                             | London rocket                |
| Brassicaceae    | <i>Rorippa laciniata</i>                             |                              |
| Cactaceae       | <i>Harrisia tortuosa</i>                             | harrisia cactus              |
| Cactaceae       | * <i>Opuntia aurantiaca</i>                          | tiger pear                   |
| Cactaceae       | * <i>Opuntia stricta</i> var. <i>stricta</i>         | common prickly pear          |
| Campanulaceae   | <i>Wahlenbergia communis</i>                         | tufted bluebell              |
| Campanulaceae   | <i>Wahlenbergia fluminalis</i>                       | river bluebell               |
| Campanulaceae   | <i>Wahlenbergia gracilentia</i>                      | annual bluebell              |
| Campanulaceae   | <i>Wahlenbergia gracilis</i>                         | Australian bluebell          |
| Campanulaceae   | <i>Wahlenbergia littorcola</i>                       |                              |
| Campanulaceae   | <i>Wahlenbergia luteola</i>                          |                              |
| Campanulaceae   | <i>Wahlenbergia planiflora</i>                       | native bluebell              |
| Campanulaceae   | <i>Wahlenbergia</i> sp.                              |                              |
| Campanulaceae   | <i>Wahlenbergia stricta</i>                          | tall bluebell                |
| Campanulaceae   | <i>Wahlenbergia victoriensis</i>                     |                              |
| Caryophyllaceae | * <i>Arenaria leptoclados</i>                        | lesser thyme-leaved sandwort |
| Caryophyllaceae | * <i>Cerastium glomeratum</i>                        | mouse-ear chickweed          |
| Caryophyllaceae | <i>Gypsophila tubulosa</i>                           | annual chalkwort             |
| Caryophyllaceae | * <i>Paronychia brasiliiana</i>                      | Chilean whitlow wort         |
| Caryophyllaceae | * <i>Petrorhagia nanteuillii</i>                     | proliferous pink             |
| Caryophyllaceae | * <i>Petrorhagia velutina</i>                        |                              |
| Caryophyllaceae | * <i>Polycarpon tetraphyllum</i>                     | four-leaved allseed          |
| Caryophyllaceae | * <i>Silene gallica</i> var. <i>gallica</i>          | French catchfly              |
| Caryophyllaceae | * <i>Spergularia rubra</i>                           | sandspurry                   |
| Caryophyllaceae | <i>Spergularia</i> sp. 3                             |                              |
| Caryophyllaceae | <i>Stellaria flaccida</i>                            | forest starwort              |
| Caryophyllaceae | * <i>Stellaria media</i>                             | common chickweed             |
| Caryophyllaceae | <i>Stellaria pungens</i>                             | prickly starwort             |
| Casuarinaceae   | <i>Allocasuarina brachystachya</i>                   |                              |
| Casuarinaceae   | <i>Allocasuarina diminuta</i> subsp. <i>diminuta</i> |                              |
| Casuarinaceae   | <i>Allocasuarina distyla</i>                         |                              |
| Casuarinaceae   | <i>Allocasuarina gymnanthera</i>                     |                              |
| Casuarinaceae   | <i>Allocasuarina littoralis</i>                      | black sheoak                 |
| Casuarinaceae   | <i>Allocasuarina luehmannii</i>                      | bulloak                      |
| Casuarinaceae   | <i>Allocasuarina torulosa</i>                        | forest oak                   |

| Family         | Scientific Name                                        | Common Name              |
|----------------|--------------------------------------------------------|--------------------------|
| Casuarinaceae  | <i>Allocasuarina verticillata</i>                      | drooping sheoak          |
| Casuarinaceae  | <i>Casuarina glauca</i>                                | swamp oak                |
| Casuarinaceae  | <i>Maytenus cunninghamii</i>                           | yellow-berry bush        |
| Celastraceae   | <i>Maytenus silvestris</i>                             | narrow-leaved orangebark |
| Chenopodiaceae | <i>Atriplex semibaccata</i>                            | creeping saltbush        |
| Chenopodiaceae | <i>Atriplex</i> sp.                                    |                          |
| Chenopodiaceae | <i>Atriplex spinibractea</i>                           |                          |
| Chenopodiaceae | * <i>Chenopodium album</i>                             | fat hen                  |
| Chenopodiaceae | <i>Chenopodium auricomiforme</i>                       |                          |
| Chenopodiaceae | <i>Chenopodium melanocarpum</i>                        | black crumbweed          |
| Chenopodiaceae | <i>Chenopodium pumilio</i>                             | small crumbweed          |
| Chenopodiaceae | <i>Chenopodium</i> sp.                                 |                          |
| Chenopodiaceae | <i>Dysphania glomulifera</i> subsp. <i>glomulifera</i> |                          |
| Chenopodiaceae | <i>Einadia hastata</i>                                 | berry saltbush           |
| Chenopodiaceae | <i>Einadia nutans</i>                                  | climbing saltbush        |
| Chenopodiaceae | <i>Einadia nutans</i> subsp. <i>linifolia</i>          | climbing saltbush        |
| Chenopodiaceae | <i>Einadia nutans</i> subsp. <i>nutans</i>             | climbing saltbush        |
| Chenopodiaceae | <i>Einadia polygonoides</i>                            |                          |
| Chenopodiaceae | <i>Einadia</i> sp.                                     |                          |
| Chenopodiaceae | <i>Einadia trigonos</i> subsp. <i>leiocarpa</i>        | fishweed                 |
| Chenopodiaceae | <i>Einadia trigonos</i> subsp. <i>stellulata</i>       |                          |
| Chenopodiaceae | <i>Enchylaena tomentosa</i>                            | ruby saltbush            |
| Chenopodiaceae | <i>Maireana decalvans</i>                              | black cotton bush        |
| Chenopodiaceae | <i>Maireana enchylaenoides</i>                         |                          |
| Chenopodiaceae | <i>Maireana microphylla</i>                            | small-leaved bluebush    |
| Chenopodiaceae | <i>Salsola kali</i> var. <i>kali</i>                   |                          |
| Chenopodiaceae | <i>Sclerolaena birchii</i>                             | galvanized burr          |
| Chenopodiaceae | <i>Sclerolaena muricata</i>                            | black rolpolyp           |
| Chloanthaceae  | <i>Spartothamnella juncea</i>                          | bead bush                |
| Clusiaceae     | <i>Hypericum gramineum</i>                             | small St Johns wort      |
| Convolvulaceae | <i>Convolvulus erubescens</i>                          |                          |
| Convolvulaceae | <i>Dichondra repens</i>                                | kidney weed              |
| Convolvulaceae | <i>Dichondra</i> species A                             | kidney weed              |
| Convolvulaceae | <i>Evolvulus alsinoides</i>                            |                          |
| Convolvulaceae | <i>Evolvulus alsinoides</i> var. <i>decumbens</i>      |                          |
| Crassulaceae   | <i>Crassula decumbens</i> var. <i>decumbens</i>        |                          |
| Crassulaceae   | <i>Crassula sieberiana</i>                             | Australian stonecrop     |
| Crassulaceae   | <i>Crassula sieberiana</i> subsp. <i>sieberiana</i>    | Australian stonecrop     |
| Cucurbitaceae  | * <i>Citrullus lanatus</i> var. <i>lanatus</i>         | wild melon               |
| Dilleniaceae   | <i>Hibbertia acicularis</i>                            | prickly Guinea flower    |
| Dilleniaceae   | <i>Hibbertia aspera</i>                                | rough Guinea flower      |
| Dilleniaceae   | <i>Hibbertia linearis</i>                              |                          |
| Dilleniaceae   | <i>Hibbertia obtusifolia</i>                           | hoary Guinea flower      |

| Family               | Scientific Name                                     | Common Name          |
|----------------------|-----------------------------------------------------|----------------------|
| Dilleniaceae         | <i>Hibbertia riparia</i>                            | Dilleniaceae         |
| Dilleniaceae         | <i>Hibbertia</i> sp. nov.                           |                      |
| Droseraceae          | <i>Drosera peltata</i> subsp. <i>peltata</i>        | sundew               |
| Epacridaceae         | <i>Astroloma humifusum</i>                          | native cranberry     |
| Epacridaceae         | <i>Epacris microphylla</i> var. <i>microphylla</i>  |                      |
| Epacridaceae         | <i>Leucopogon muticus</i>                           | blunt beard-heath    |
| Epacridaceae         | <i>Melichrus erubescens</i>                         | ruby urn heath       |
| Epacridaceae         | <i>Melichrus urceolatus</i>                         | urn heath            |
| Epacridaceae         | <i>Styphelia triflora</i>                           | pink five-corners    |
| Euphorbiaceae        | <i>Beyeria viscosa</i>                              | pinkwood             |
| Euphorbiaceae        | <i>Breynia oblongifolia</i>                         | coffee bush          |
| Euphorbiaceae        | <i>Chamaesyce dallachyana</i>                       | spurge               |
| Euphorbiaceae        | <i>Chamaesyce drummondii</i>                        | caustic weed         |
| Euphorbiaceae        | <i>Euphorbia eremophila</i>                         | desert spurge        |
| Euphorbiaceae        | * <i>Euphorbia peplus</i> (prob.)                   | petty spurge         |
| Euphorbiaceae        | <i>Euphorbia planiticola</i>                        | plains spurge        |
| Euphorbiaceae        | <i>Phyllanthus gasstroemii</i>                      |                      |
| Euphorbiaceae        | <i>Phyllanthus hirtellus</i>                        |                      |
| Euphorbiaceae        | <i>Phyllanthus similis</i>                          |                      |
| Euphorbiaceae        | <i>Phyllanthus virgatus</i>                         |                      |
| Euphorbiaceae        | <i>Poranthera microphylla</i>                       |                      |
| Euphorbiaceae        | * <i>Ricinus communis</i>                           | castor oil plant     |
| Fabaceae (Faboideae) | * <i>Medicago minima</i>                            | woolly burr medic    |
| Fabaceae (Faboideae) | <i>Bossiaea buxifolia</i>                           |                      |
| Fabaceae (Faboideae) | <i>Bossiaea heterophylla</i>                        | variable bossiaea    |
| Fabaceae (Faboideae) | <i>Bossiaea obcordata</i>                           | spiny bossiaea       |
| Fabaceae (Faboideae) | <i>Bossiaea prostrata</i> — <i>buxifolia</i>        |                      |
| Fabaceae (Faboideae) | <i>Chorizema parviflorum</i>                        | eastern flame pea    |
| Fabaceae (Faboideae) | <i>Daviesia acicularis</i>                          |                      |
| Fabaceae (Faboideae) | <i>Daviesia genistifolia</i>                        | broom bitter pea     |
| Fabaceae (Faboideae) | <i>Daviesia leptophylla</i>                         |                      |
| Fabaceae (Faboideae) | <i>Daviesia ulicifolia</i> subsp. <i>ulicifolia</i> | gorse bitter pea     |
| Fabaceae (Faboideae) | <i>Desmodium brachypodum</i>                        | large tick-trefoil   |
| Fabaceae (Faboideae) | <i>Desmodium gunnii</i>                             | slender tick trefoil |
| Fabaceae (Faboideae) | <i>Desmodium rhytidophyllum</i>                     |                      |
| Fabaceae (Faboideae) | <i>Desmodium varians</i>                            | slender tick-trefoil |
| Fabaceae (Faboideae) | <i>Dillwynia sericea</i>                            |                      |
| Fabaceae (Faboideae) | <i>Glycine clandestina</i>                          |                      |
| Fabaceae (Faboideae) | <i>Glycine latifolia</i>                            |                      |
| Fabaceae (Faboideae) | <i>Glycine</i> sp.                                  |                      |
| Fabaceae (Faboideae) | <i>Glycine ?stenophita</i>                          |                      |
| Fabaceae (Faboideae) | <i>Glycine tabacina</i>                             |                      |
| Fabaceae (Faboideae) | <i>Hardenbergia violacea</i>                        | false sarsaparilla   |
| Fabaceae (Faboideae) | <i>Hovea linearis</i>                               | narrow-leaf hovea    |
| Fabaceae (Faboideae) | <i>Indigofera australis</i>                         | native indigo        |

| Family                        | Scientific Name                                   | Common Name            |
|-------------------------------|---------------------------------------------------|------------------------|
| Fabaceae (Faboideae)          | <i>Jacksonia scoparia</i>                         | dogwood                |
| Fabaceae (Faboideae)          | <i>Kennedia rubicunda</i>                         | red Kennedy pea        |
| Fabaceae (Faboideae)          | <i>Lotus australis</i>                            | Australian trefoil     |
| Fabaceae (Faboideae)          | * <i>Medicago minima</i>                          | woolly burr medic      |
| Fabaceae (Faboideae)          | * <i>Medicago orbicularis</i>                     | button medic           |
| Fabaceae (Faboideae)          | * <i>Medicago polymorpha</i>                      | burr medic             |
| Fabaceae (Faboideae)          | * <i>Medicago sativa</i>                          | lucerne                |
| Fabaceae (Faboideae)          | <i>Pultenaea cinerascens</i>                      |                        |
| Fabaceae (Faboideae)          | <i>Pultenaea microphylla</i>                      | spreading bush-pea     |
| Fabaceae (Faboideae)          | <i>Swainsona oroboides</i>                        |                        |
| Fabaceae (Faboideae)          | <i>Templetonia stenophylla</i>                    | leafy templetonia      |
| Fabaceae (Faboideae)          | * <i>Trifolium arvense</i>                        | haresfoot clover       |
| Fabaceae (Faboideae)          | * <i>Trifolium campestre</i>                      | hop clover             |
| Fabaceae (Faboideae)          | * <i>Trifolium dubium</i>                         | yellow suckling clover |
| Fabaceae (Faboideae)          | * <i>Trifolium fragiferum</i>                     | strawberry clover      |
| Fabaceae (Faboideae)          | * <i>Trifolium globosum</i>                       | globe clover           |
| Fabaceae (Faboideae)          | * <i>Trifolium glomeratum</i>                     | clustered clover       |
| Fabaceae (Faboideae)          | * <i>Trifolium repens</i>                         | white clover           |
| Fabaceae (Faboideae)          | * <i>Trifolium</i> sp.                            |                        |
| Fabaceae (Faboideae)          | <i>Zornia dyctiocarpa</i>                         | zornia                 |
| Fabaceae (Faboideae)          | <i>Zornia dyctiocarpa</i> var. <i>dyctiocarpa</i> | zornia                 |
| Fabaceae (Mimosoideae)        | <i>Acacia binervia</i>                            | coast myall            |
| Fabaceae (Mimosoideae)        | <i>Acacia cheelii</i>                             | motherumbah            |
| Fabaceae (Mimosoideae)        | <i>Acacia crassa</i> subsp. <i>crassa</i>         | curracabah             |
| Fabaceae (Mimosoideae)        | <i>Acacia deanei</i> subsp. <i>deanei</i>         | Deanes wattle          |
| Fabaceae (Mimosoideae)        | <i>Acacia decora</i>                              | western golden wattle  |
| Fabaceae (Mimosoideae)        | <i>Acacia doratoxylon</i>                         | currawang              |
| Fabaceae (Mimosoideae)        | <i>Acacia falcata</i>                             | hickory wattle         |
| Fabaceae (Mimosoideae)        | <i>Acacia falciformis</i>                         | broad-leaved hickory   |
| Fabaceae (Mimosoideae)        | <i>Acacia hakeoides</i>                           | hakea wattle           |
| Fabaceae (Mimosoideae)        | <i>Acacia implexa</i>                             | hickory wattle         |
| Fabaceae (Mimosoideae)        | <i>Acacia irrorata</i>                            | green wattle           |
| Fabaceae (Mimosoideae)        | <i>Acacia linearifolia</i>                        | narrow-leaved wattle   |
| Fabaceae (Mimosoideae)        | <i>Acacia melvillei</i>                           | yarran                 |
| Fabaceae (Mimosoideae)        | <i>Acacia paradoxa</i>                            | kangaroo thorn         |
| Fabaceae (Mimosoideae)        | <i>Acacia parvipinnula</i>                        | silver-stemmed wattle  |
| <b>Fabaceae (Mimosoideae)</b> | <b><i>Acacia pendula</i></b>                      | <b>weeping myall</b>   |
| Fabaceae (Mimosoideae)        | <i>Acacia piligera</i>                            | gold-dust wattle       |
| Fabaceae (Mimosoideae)        | <i>Acacia pravifolia</i>                          | coil-pod wattle        |
| Fabaceae (Mimosoideae)        | <i>Acacia salicina</i>                            | cooba                  |
| Fabaceae (Mimosoideae)        | <i>Acacia</i> sp.                                 |                        |
| Fabaceae (Mimosoideae)        | <i>Acacia spectabilis</i>                         | Mudgee wattle          |
| Fabaceae (Mimosoideae)        | <i>Acacia uncinata</i>                            | gold-dust wattle       |
| Fabaceae (Mimosoideae)        | <i>Acacia venulosa</i>                            |                        |
| Fumariaceae                   | * <i>Fumaria muralis</i> subsp. <i>muralis</i>    | wall fumitory          |

| Family       | Scientific Name                                         | Common Name         |
|--------------|---------------------------------------------------------|---------------------|
| Geraniaceae  | <i>*Erodium cicutarium</i>                              | common storksbill   |
| Geraniaceae  | <i>Erodium crinitum</i>                                 | blue storksbill     |
| Geraniaceae  | <i>Geranium solanderi</i>                               | native geranium     |
| Geraniaceae  | <i>Geranium solanderi</i> var. <i>solanderi</i>         | native geranium     |
| Geraniaceae  | <i>Geranium</i> sp.                                     |                     |
| Goodeniaceae | <i>Brunonia australis</i>                               | blue pincushion     |
| Goodeniaceae | <i>Dampiera lanceolata</i> var. <i>lanceolata</i>       |                     |
| Goodeniaceae | <i>Goodenia hederacea</i> subsp. <i>hederacea</i>       |                     |
| Goodeniaceae | <i>Goodenia heterophylla</i> subsp. <i>heterophylla</i> |                     |
| Goodeniaceae | <i>Goodenia macbarronii</i>                             | narrow goodenia     |
| Goodeniaceae | <i>Goodenia ovata</i>                                   | hop goodenia        |
| Goodeniaceae | <i>Goodenia paniculata</i>                              |                     |
| Goodeniaceae | <i>Goodenia pinnatifida</i>                             |                     |
| Goodeniaceae | <i>Goodenia rotundifolia</i>                            |                     |
| Goodeniaceae | <i>Goodenia</i> sp.                                     |                     |
| Haloragaceae | <i>Gonocarpus elatus</i>                                |                     |
| Haloragaceae | <i>Haloragis heterophylla</i>                           | variable raspwort   |
| Haloragaceae | <i>Myriophyllum verrucosum</i>                          | red water-milfoil   |
| Lamiaceae    | <i>Ajuga australis</i>                                  | Austral bugle       |
|              | <i>*Marrubium vulgare</i>                               | horehound           |
| Lamiaceae    | <i>Mentha satureioides</i>                              | native pennyroyal   |
| Lamiaceae    | <i>Prostanthera nivea</i>                               | snowy mint-bush     |
| Lamiaceae    | <i>Prostanthera nivea</i> var. <i>nivea</i>             | snowy mint-bush     |
| Lamiaceae    | <i>Prostanthera ovalifolia</i>                          | oval-leaf mint-bush |
| Lamiaceae    | <i>Prostanthera prunelloides</i>                        | prunella mint-bush  |
| Lamiaceae    | <i>Salvia reflexa</i>                                   | mintweed            |
| Lamiaceae    | <i>Scutellaria humilis</i>                              | dwarf skullcap      |
| Lamiaceae    | <i>*Stachys arvensis</i>                                | stagger weed        |
| Lamiaceae    | <i>Teucrium</i> species A                               |                     |
| Lobeliaceae  | <i>Isotoma axillaris</i>                                | showy isotome       |
| Lobeliaceae  | <i>Pratia concolor</i>                                  | poison pratia       |
| Lobeliaceae  | <i>Pratia purpurascens</i>                              | whiteroot           |
| Loganiaceae  | <i>Mitrasacme polymorpha</i>                            |                     |
| Loranthaceae | <i>Amyema cabbagei</i>                                  | sheoak mistletoe    |
| Loranthaceae | <i>Amyema congener</i> subsp. <i>congener</i>           |                     |
| Loranthaceae | <i>Amyema gaudichaudii</i>                              |                     |
| Loranthaceae | <i>Amyema miquelii</i>                                  | box mistletoe       |
| Loranthaceae | <i>Amyema pendulum</i> subsp. <i>pendulum</i>           | drooping mistletoe  |
| Loranthaceae | <i>Amyema</i> sp.                                       |                     |
| Loranthaceae | <i>Lysiana exocarpi</i> subsp. <i>tenuis</i>            | harlequin mistletoe |
| Loranthaceae | <i>Muellerina eucalyptoides</i>                         |                     |
| Malvaceae    | <i>Abutilon oxycarpum</i>                               | flannel weed        |

| Family      | Scientific Name                                    | Common Name               |
|-------------|----------------------------------------------------|---------------------------|
| Malvaceae   | <i>Gossypium sturtianum</i> var. <i>sturtianum</i> | Sturts desert rose        |
| Malvaceae   | <i>Hibiscus sturtii</i>                            | hill hibiscus             |
| Malvaceae   | <i>Hibiscus sturtii</i> var. <i>sturtii</i>        |                           |
| Malvaceae   | *? <i>Modiola caroliniana</i>                      | red-flowered mallow       |
| Malvaceae   | * <i>Malva parviflora</i>                          | small-flowered mallow     |
| Malvaceae   | * <i>Modiola caroliniana</i>                       | red-flowered mallow       |
| Malvaceae   | * <i>Pavonia hastata</i>                           | pavonia                   |
| Malvaceae   | * <i>Sida cordifolia</i>                           |                           |
| Malvaceae   | <i>Sida corrugata</i>                              |                           |
| Malvaceae   | <i>Sida cunninghamii</i>                           |                           |
| Malvaceae   | <i>Sida filiformis</i>                             |                           |
| Malvaceae   | <i>Sida petrophila</i>                             |                           |
| Malvaceae   | * <i>Sida rhombifolia</i>                          | Paddys lucerne            |
| Malvaceae   | <i>Sida</i> sp.                                    |                           |
| Malvaceae   | <i>Sida spinosa</i>                                |                           |
| Malvaceae   | <i>Sida subspicata</i>                             |                           |
| Malvaceae   | <i>Sida trichopoda</i>                             |                           |
| Meliaceae   | <i>Melia azedarach</i>                             | white cedar               |
| Moraceae    | <i>Ficus rubiginosa</i> form <i>rubiginosa</i>     | rusty fig                 |
| Myoporaceae | <i>Eremophila debilis</i>                          | amulla                    |
| Myoporaceae | <i>Eremophila deserti</i>                          | turkeybush                |
| Myoporaceae | <i>Myoporum montanum</i>                           | western boobialla         |
| Myrsinaceae | <i>Rapanea variabilis</i>                          | muttonwood                |
| Myrtaceae   | <i>Angophora floribunda</i>                        | rough-barked apple        |
| Myrtaceae   | <i>Backhousia myrtifolia</i>                       | grey myrtle               |
| Myrtaceae   | <i>Callistemon linearis</i>                        | narrow-leaved bottlebrush |
| Myrtaceae   | <i>Eucalyptus albens</i>                           | white box                 |
| Myrtaceae   | <i>Eucalyptus albens</i> — <i>moluccana</i>        | white/grey box            |
| Myrtaceae   | <i>Eucalyptus blakelyi</i>                         | Blakelys red gum          |
| Myrtaceae   | <i>Eucalyptus blakelyi</i> — <i>tereticornis</i>   |                           |
| Myrtaceae   | <i>Eucalyptus ?bridgesiana</i>                     | apple box                 |
| Myrtaceae   | <i>Eucalyptus crebra</i>                           | narrow-leaved ironbark    |
| Myrtaceae   | <i>Eucalyptus dawsonii</i>                         | slaty gum                 |
| Myrtaceae   | <i>Eucalyptus dwyeri</i>                           | Dwyers red gum            |
| Myrtaceae   | <i>Eucalyptus fibrosa</i>                          | broad-leaved ironbark     |
| Myrtaceae   | <i>Eucalyptus melliodora</i>                       | yellow box                |
| Myrtaceae   | <i>Eucalyptus microcarpa</i>                       | western grey box          |
| Myrtaceae   | <i>Eucalyptus moluccana</i>                        | grey box                  |
| Myrtaceae   | <i>Eucalyptus moluccana</i> — <i>microcarpa</i>    |                           |
| Myrtaceae   | <i>Eucalyptus punctata</i>                         | grey gum                  |
| Myrtaceae   | <i>Eucalyptus</i> sp.                              |                           |
| Myrtaceae   | <i>Eucalyptus tereticornis</i>                     | forest red gum            |
| Myrtaceae   | <i>Kunzea ambigua</i>                              | tick bush                 |
| Myrtaceae   | <i>Kunzea</i> sp. 'Mt Kaputar'                     |                           |
| Myrtaceae   | <i>Kunzea</i> species D                            |                           |

| Family            | Scientific Name                                     | Common Name               |
|-------------------|-----------------------------------------------------|---------------------------|
| Myrtaceae         | <i>Leptospermum parvifolium</i>                     | small-leaf tea tree       |
| Myrtaceae         | <i>Leptospermum polyanthum</i>                      |                           |
| Myrtaceae         | <i>Leptospermum trinervium</i>                      | flaky-barked tea tree     |
| Myrtaceae         | <i>Melaleuca decora</i>                             | white feather honeymyrtle |
| Myrtaceae         | <i>Melaleuca nodosa</i>                             | ball honeymyrtle          |
| Myrtaceae         | <i>Melaleuca sieberi</i>                            | Siebers paperbark         |
| Myrtaceae         | <i>Melaleuca uncinata</i>                           | broombush                 |
| Myrtaceae         | <i>Micromyrtus ciliata</i>                          | fringed heath-myrtle      |
| Myrtaceae         | <i>Micromyrtus sessilis</i>                         | a heath-myrtle            |
| Nyctaginaceae     | <i>Boerhavia dominii</i>                            | tarvine                   |
| Oleaceae          | <i>Notelaea microcarpa</i> var. <i>microcarpa</i>   | native olive              |
| Onagraceae        | <i>Ludwigia peploides</i>                           | water primrose            |
| Oxalidaceae       | <i>Oxalis chnoodes</i>                              | wood sorrell              |
| Oxalidaceae       | <i>Oxalis exilis</i>                                |                           |
| Oxalidaceae       | <i>Oxalis perennans</i>                             |                           |
| Oxalidaceae       | <i>Oxalis</i> sp.                                   |                           |
| Papaveraceae      | * <i>Argemone ochroleuca</i>                        | Mexican poppy             |
| Phytolaccaceae    | * <i>Phytolacca octandra</i>                        | inkweed                   |
| Pittosporaceae    | <i>Bursaria spinosa</i> subsp. <i>spinosa</i>       | blackthorn                |
| Pittosporaceae    | <i>Pittosporum multiflorum</i>                      | orange thorn              |
| Plantaginaceae    | <i>Plantago debilis</i>                             |                           |
| Plantaginaceae    | <i>Plantago gaudichaudii</i>                        |                           |
| Plantaginaceae    | * <i>Plantago lanceolata</i>                        | lamb's tongues            |
| Plantaginaceae    | * <i>Plantago myosuros</i>                          |                           |
| Plantaginaceae    | <i>Plantago varia</i>                               | variable plantain         |
| Polygonaceae      | <i>Persicaria prostrata</i>                         | creeping knotweed         |
| Polygonaceae      | * <i>Polygonum arenastrum</i>                       | wireweed                  |
| Polygonaceae      | <i>Polygonum plebeium</i>                           | small knotweed            |
| Polygonaceae      | <i>Rumex brownii</i>                                | swamp dock                |
| Polygonaceae      | * <i>Rumex crispus</i>                              | curled dock               |
| Polygonaceae      | <i>Rumex</i> sp.                                    |                           |
| Portulacaceae     | <i>Calandrinia eremaea</i>                          |                           |
| Portulacaceae     | <i>Calandrinia pickeringii</i>                      |                           |
| Primulaceae       | * <i>Anagallis arvensis</i>                         | scarlet pimpernel         |
| Proteaceae        | <i>Grevillea montana</i>                            |                           |
| Proteaceae        | * <i>Grevillea robusta</i>                          | silky oak                 |
| Proteaceae        | <i>Isopogon dawsonii</i>                            | drumsticks                |
| Proteaceae        | <i>Persoonia linearis</i>                           | narrow-leaved geebung     |
| Ranunculaceae     | <i>Clematis aristata</i>                            | old man's beard           |
| Ranunculaceae     | <i>Clematis glycinoides</i> var. <i>glycinoides</i> | headache vine             |
| Ranunculaceae     | <i>Ranunculus</i> sp.                               |                           |
| Rhamnaceae        | <i>Alphitonia excelsa</i>                           | red ash                   |
| Rhamnaceae        | <i>Pomaderris ?intermedia</i>                       |                           |
| Rhamnaceae        | <i>Pomaderris ferruginea</i>                        |                           |
| <b>Rhamnaceae</b> | <b><i>Pomaderris queenslandica</i></b>              |                           |

| Family            | Scientific Name                                         | Common Name           |
|-------------------|---------------------------------------------------------|-----------------------|
| <b>Rhamnaceae</b> | <b><i>Pomaderris reperta</i></b>                        |                       |
| Rhamnaceae        | <i>Spyridium buxifolium</i>                             |                       |
| Rosaceae          | <i>Acaena echinata</i>                                  |                       |
| Rosaceae          | <i>Acaena</i> sp.                                       |                       |
| Rosaceae          | <i>Rubus fruitcosus</i> sp. agg.                        | blackberry            |
| Rubiaceae         | <i>Asperula conferta</i>                                | common woodruff       |
| Rubiaceae         | <i>Asperula cunninghamii</i>                            | twining woodruff      |
| Rubiaceae         | <i>Galium binifolium</i>                                |                       |
| Rubiaceae         | <i>Galium gaudichaudii</i>                              | rough bedstraw        |
| Rubiaceae         | <i>Galium migrans</i>                                   | bedstraw              |
| Rubiaceae         | * <i>Galium murale</i>                                  | small bedstraw        |
| Rubiaceae         | <i>Galium propinquum</i>                                | Maori bedstraw        |
| Rubiaceae         | <i>Galium</i> sp.                                       |                       |
| Rubiaceae         | <i>Opercularia aspera</i>                               | coarse stinkweed      |
| Rubiaceae         | <i>Opercularia diphylla</i>                             | stinkweed             |
| Rubiaceae         | <i>Opercularia hispida</i>                              | hairy stinkweed       |
| Rubiaceae         | <i>Opercularia varia</i>                                | variable stinkweed    |
| Rubiaceae         | <i>Pomax umbellata</i>                                  | pomax                 |
| Rubiaceae         | <i>Psydrax odorata</i>                                  | shiny-leaved canthium |
| Rubiaceae         | * <i>Richardia stellaris</i>                            |                       |
| Rutaceae          | <i>Boronia anethifolia</i>                              | narrow-leaved boronia |
| Rutaceae          | <i>Correa reflexa</i> var. <i>reflexa</i>               | common correa         |
| Rutaceae          | <i>Geijera parviflora</i>                               | wilga                 |
| Rutaceae          | <i>Geijera salicifolia</i> var. <i>salicifolia</i>      | brush wilga           |
| Rutaceae          | <i>Phebalium squamulosum</i> subsp. <i>gracile</i>      | scaly phebalium       |
| Rutaceae          | <i>Phebalium squamulosum</i> subsp. <i>lineare</i>      | scaly phebalium       |
| Rutaceae          | <i>Philotheca myoporoides</i> subsp. <i>myoporoides</i> |                       |
| Rutaceae          | <i>Zieria cytisoides</i>                                | downy zieria          |
| Salicaceae        | * <i>Salix bablyonica</i>                               | weeping willow        |
| Salicaceae        | * <i>Salix matsudana</i>                                | tortured willow       |
| Santalaceae       | <i>Exocarpos cupressiformis</i>                         | native cherry         |
| Santalaceae       | <i>Santalum lanceolatum</i>                             | northern sandalwood   |
| Sapindaceae       | <i>Dodonaea triangularis</i>                            |                       |
| Sapindaceae       | <i>Dodonaea triquetra</i>                               | large-leaf hop-bush   |
| Sapindaceae       | <i>Dodonaea viscosa</i>                                 | sticky hop bush       |
| Sapindaceae       | <i>Dodonaea viscosa</i> subsp. <i>cuneata</i>           | sticky hop-bush       |
| Sapindaceae       | <i>Dodonaea viscosa</i> subsp. <i>mucronata</i>         |                       |
| Sapindaceae       | <i>Dodonaea viscosa</i> subsp. <i>spatulata</i>         |                       |
| Scrophulariaceae  | <i>Gratiola pedunculata</i>                             |                       |
| Scrophulariaceae  | * <i>Verbascum virgatum</i>                             | twiggy mullein        |
| Scrophulariaceae  | <i>Veronica calycina</i>                                | hairy speedwell       |

| Family           | Scientific Name                                       | Common Name            |
|------------------|-------------------------------------------------------|------------------------|
| Scrophulariaceae | <i>Veronica plebeia</i>                               | trailing speedwell     |
| Solanaceae       | * <i>Datura ferox</i>                                 | fierce thornapple      |
| Solanaceae       | * <i>Lycium ferocissimum</i>                          | African boxthorn       |
| Solanaceae       | <i>Nicotiana suaveolens</i>                           | native tobacco         |
| Solanaceae       | <i>Solanum americanum</i>                             | glossy nightshade      |
| Solanaceae       | <i>Solanum brownii</i>                                | violet nightshade      |
| Solanaceae       | <i>Solanum campanulatum</i>                           |                        |
| Solanaceae       | <i>Solanum cinereum</i>                               | Narrawa burr           |
| Solanaceae       | * <i>Solanum nigrum</i>                               | black-berry nightshade |
| Solanaceae       | <i>Solanum opacum</i>                                 | green-berry nightshade |
| Solanaceae       | <i>Solanum prinophyllum</i>                           | forest nightshade      |
| Solanaceae       | <i>Solanum</i> sp.                                    |                        |
| Solanaceae       | <i>Solanum stelligerum</i>                            | devils needles         |
| Solanaceae       | * <i>Solanum rostratum</i>                            | pincushion nightshade  |
| Stackhousiaceae  | <i>Stackhousia monogyna</i>                           | creamy candles         |
| Stackhousiaceae  | <i>Stackhousia muricata</i>                           |                        |
| Stackhousiaceae  | <i>Stackhousia</i> sp.                                |                        |
| Stackhousiaceae  | <i>Stackhousia viminea</i>                            | slender stackhousia    |
| Sterculiaceae    | <i>Brachychiton populneus</i> subsp. <i>populneus</i> | kurrajong              |
| Sterculiaceae    | <b><i>Commersonia rosea</i></b>                       |                        |
| Sterculiaceae    | <b><i>Lasiopetalum longistamineum</i></b>             |                        |
| Sterculiaceae    | <i>Rulingia dasyphylla</i>                            | kerrawang              |
| Sterculiaceae    | <i>Rulingia</i> sp.                                   |                        |
| Verbenaceae      | * <i>Verbena bonariensis</i>                          | purpletop              |
| Verbenaceae      | * <i>Verbena rigida</i>                               | veined verbena         |
| Thymelaeaceae    | <i>Pimelea latifolia</i> subsp. <i>elliptifolia</i>   |                        |
| Thymelaeaceae    | <i>Pimelea latifolia</i> subsp. <i>latifolia</i>      |                        |
| Urticaceae       | * <i>Urtica urens</i>                                 | small nettle           |
| Verbenaceae      | <i>Clerodendrum tomentosum</i>                        | hairy clerodendrum     |
| Verbenaceae      | * <i>Verbena bonariensis</i>                          | purpletop              |
| Verbenaceae      | * <i>Verbena litoralis</i>                            | coastal verbena        |
| Verbenaceae      | * <i>Verbena rigida</i> var. <i>rigida</i>            | veined verbena         |
| Violaceae        | <i>Viola hederacea</i>                                | ivy-leaved violet      |

**Table 2 – Flora Species Recorded from Additional Biodiversity Offset Area**

| Family                                                        | Scientific Name                                         | Common Names           |
|---------------------------------------------------------------|---------------------------------------------------------|------------------------|
| <b>Coniferopsida (Conifers)</b>                               |                                                         |                        |
| Cupressaceae                                                  | <i>Callitris endlicheri</i>                             | black cypress pine     |
| <b>Filicopsida (Ferns)</b>                                    |                                                         |                        |
| Adiantaceae                                                   | <i>Cheilanthes distans</i>                              | bristly cloak fern     |
| Adiantaceae                                                   | <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>        | poison rock fern       |
| <b>Magnoliopsida (Flowering Plants) – Lillidae (Monocots)</b> |                                                         |                        |
| Anthericaceae                                                 | <i>Dichopogon strictus</i>                              | chocolate lily         |
| Anthericaceae                                                 | <i>Laxmannia gracilis</i>                               | slender wire lily      |
| Anthericaceae                                                 | <i>Tricoryne elatior</i>                                | yellow autumn-lily     |
| Commelinaceae                                                 | <i>Commelina cyanea</i>                                 | native wandering Jew   |
| Cyperaceae                                                    | <i>Carex appressa</i>                                   | tall sedge             |
| Cyperaceae                                                    | <i>Cyperus gracilis</i>                                 |                        |
| Cyperaceae                                                    | <i>Fimbristylis dichotoma</i>                           | common fridge-sedge    |
| Phormiaceae                                                   | <i>Dianella</i> sp.                                     |                        |
| Poaceae                                                       | * <i>Aristida jerichoensis</i> var. <i>jerichoensis</i> | Jericho wiregrass      |
| Poaceae                                                       | <i>Aristida queenslandica</i> var. <i>queenslandica</i> |                        |
| Poaceae                                                       | <i>Aristida ramosa</i>                                  | purple wiregrass       |
| Poaceae                                                       | <i>Aristida</i> sp.                                     |                        |
| Poaceae                                                       | <i>Aristida vagans</i>                                  | threeawn speargrass    |
| Poaceae                                                       | <i>Austrodanthonia fulva</i>                            | wallaby grass          |
| Poaceae                                                       | <i>Austrodanthonia</i> sp.                              |                        |
| Poaceae                                                       | <i>Austrostipa scabra</i>                               | speargrass             |
| Poaceae                                                       | <i>Austrostipa scabra</i> subsp. <i>scabra</i>          | corkscrew grass        |
| Poaceae                                                       | <i>Austrostipa verticillata</i>                         | slender bamboo grass   |
| <b>Poaceae</b>                                                | <b><i>Bothriochloa biloba</i></b>                       | <b>lobed bluegrass</b> |
| Poaceae                                                       | <i>Bothriochloa decipiens</i>                           | red grass              |
| Poaceae                                                       | <i>Bothriochloa macra</i>                               | red grass              |
| Poaceae                                                       | <i>Chloris divaricata</i>                               |                        |
| Poaceae                                                       | * <i>Chloris gayana</i>                                 | Rhodes grass           |
| Poaceae                                                       | <i>Chloris truncata</i>                                 | windmill grass         |
| Poaceae                                                       | <i>Chloris ventricosa</i>                               | tall chloris           |
| Poaceae                                                       | <i>Cymbopogon refractus</i>                             | barbed wire grass      |
| Poaceae                                                       | <i>Cynodon dactylon</i>                                 | common couch           |
| Poaceae                                                       | <i>Dactyloctenium radulans</i>                          | button grass           |
| Poaceae                                                       | <i>Dichanthium sericeum</i>                             | queensland bluegrass   |
| Poaceae                                                       | <i>Dichelachne micrantha</i>                            | shorthair plumegrass   |
| Poaceae                                                       | <i>Digitaria diffusa</i>                                |                        |
| Poaceae                                                       | <i>Digitaria divaricatissima</i>                        | umbrella grass         |
| Poaceae                                                       | <i>Elymus scaber</i>                                    |                        |
| Poaceae                                                       | <i>Enneapogon gracilis</i>                              | slender nineawn        |
| Poaceae                                                       | <i>Eragrostis leptostachya</i>                          | paddock lovegrass      |

| Family                                                         | Scientific Name                                   | Common Names              |
|----------------------------------------------------------------|---------------------------------------------------|---------------------------|
| Poaceae                                                        | <i>Eragrostis parviflora</i>                      | weeping lovegrass         |
| Poaceae                                                        | <i>Eragrostis</i> sp.                             |                           |
| Poaceae                                                        | <i>Eriochloa pseudoacrotricha</i>                 | early spring grass        |
| Poaceae                                                        | <i>Eulalia aurea</i>                              | silky browntop            |
| Poaceae                                                        | * <i>Lolium perenne</i>                           | perennial ryegrass        |
| Poaceae                                                        | <i>Microlaena stipoides</i> var. <i>stipoides</i> | weeping grass             |
| Poaceae                                                        | <i>Panicum effusum</i>                            | poison or hairy panic     |
| Poaceae                                                        | <i>Panicum simile</i>                             | two-colour panic          |
| Poaceae                                                        | * <i>Paspalum dilatatum</i>                       | paspalum                  |
| Poaceae                                                        | <i>Paspalidium distans</i>                        |                           |
| Poaceae                                                        | <i>Sporobolus creber</i>                          | slender rats tail grass   |
| Poaceae                                                        | <i>Tragus australis</i>                           | small burrgrass           |
| <b>Magnoliopsida (flowering plants) – Magnoliidae (dicots)</b> |                                                   |                           |
| Acanthaceae                                                    | <i>Brunoniella australis</i>                      | blue trumpet              |
| Aizoaceae                                                      | * <i>Galenia pubescens</i>                        | galenia                   |
| Amaranthaceae                                                  | <i>Alternanthera denticulata</i>                  | lesser joyweed            |
| Amaranthaceae                                                  | * <i>Gomphrena celosioides</i>                    | gomphrena weed            |
| Amaranthaceae                                                  | <i>Ptilotus semilanatus</i>                       |                           |
| Asclepiadaceae                                                 | * <i>Gomphocarpus fruticosus</i>                  | narrow-leaved cotton bush |
| Asteraceae                                                     | <i>Calocephalus citreus</i>                       | lemon beauty-heads        |
| Asteraceae                                                     | <i>Calotis cuneifolia</i>                         | purple burr-daisy         |
| Asteraceae                                                     | <i>Calotis lappulacea</i>                         | yellow burr-daisy         |
| Asteraceae                                                     | * <i>Carthamus lanatus</i>                        | saffron thistle           |
| Asteraceae                                                     | <i>Cassinia arcuata</i>                           | sifton bush               |
| Asteraceae                                                     | <i>Cassinia laevis</i>                            | cough bush                |
| Asteraceae                                                     | <i>Chrysocephalum apiculatum</i>                  | common everlasting        |
| Asteraceae                                                     | <i>Chrysocephalum semipapposum</i>                | clustered everlasting     |
| Asteraceae                                                     | * <i>Cirsium vulgare</i>                          | spear thistle             |
| Asteraceae                                                     | * <i>Conyza bonariensis</i>                       | flaxleaf fleabane         |
| Asteraceae                                                     | <i>Epaltes australis</i>                          | spreading nut-heads       |
| Asteraceae                                                     | <i>Glossogyne tannensis</i>                       | cobblers tack             |
| Asteraceae                                                     | <i>Olearia elliptica</i>                          | sticky daisy bush         |
| Asteraceae                                                     | <i>Ozothamnus diosmifolius</i>                    | white dogwood             |
| Asteraceae                                                     | * <i>Schkuhria pinnata</i>                        |                           |
| Asteraceae                                                     | * <i>Senecio madagascariensis</i>                 | fireweed                  |
| Asteraceae                                                     | * <i>Taraxacum officinale</i>                     | dandelion                 |
| Asteraceae                                                     | <i>Vittadinia muelleri</i>                        |                           |
| Asteraceae                                                     | <i>Vittadinia pterochaeta</i>                     | rough fuzzweed            |
| Asteraceae                                                     | <i>Vittadinia</i> sp.                             |                           |
| Cactaceae                                                      | * <i>Opuntia aurantiaca</i>                       | tiger pear                |
| Cactaceae                                                      | * <i>Opuntia stricta</i> var. <i>stricta</i>      | common prickly pear       |
| Campanulaceae                                                  | <i>Wahlenbergia communis</i>                      | tufted bluebell           |
| Campanulaceae                                                  | <i>Wahlenbergia gracilis</i>                      | spawling bluebell         |
| Campanulaceae                                                  | <i>Wahlenbergia</i> sp.                           |                           |
| Caryophyllaceae                                                | * <i>Paronychia brasiliensis</i>                  | Chilean whitlow wort      |

| Family                        | Scientific Name                                       | Common Names          |
|-------------------------------|-------------------------------------------------------|-----------------------|
| Casuarinaceae                 | <i>Allocasuarina littoralis</i>                       | black sheoak          |
| Casuarinaceae                 | <i>Allocasuarina luehmannii</i>                       | bulloak               |
| Chenopodiaceae                | <i>Atriplex semibaccata</i>                           | creeping saltbush     |
| Chenopodiaceae                | <i>Einadia hastata</i>                                | berry saltbush        |
| Chenopodiaceae                | <i>Einadia nutans</i> subsp. <i>linifolia</i>         | climbing saltbush     |
| Chenopodiaceae                | <i>Einadia nutans</i> subsp. <i>nutans</i>            | climbing saltbush     |
| Chenopodiaceae                | <i>Enchylaena tomentosa</i>                           | ruby saltbush         |
| Chenopodiaceae                | <i>Maireana microphylla</i>                           | small-leaved bluebush |
| Chloanthaceae                 | <i>Spartothamnella juncea</i>                         | native broom          |
| Clusiaceae                    | <i>Hypericum gramineum</i>                            | small St Johns wort   |
| Convolvulaceae                | <i>Dichondra repens</i>                               | kidney weed           |
| Convolvulaceae                | <i>Evolvulus alsinoides</i>                           |                       |
| Dilleniaceae                  | <i>Hibbertia acicularis</i>                           |                       |
| Epacridaceae                  | <i>Leucopogon muticus</i>                             | blunt beard-heath     |
| Euphorbiaceae                 | <i>Chamaesyce drummondii</i>                          | caustic weed          |
| Euphorbiaceae                 | <i>Euphorbia planiticola</i>                          | plains spurge         |
| Euphorbiaceae                 | <i>Phyllanthus virgatus</i>                           |                       |
| Fabaceae (Faboideae)          | <i>Desmodium brachypodum</i>                          | large tick-trefoil    |
| Fabaceae (Faboideae)          | <i>Desmodium gunnii</i>                               |                       |
| Fabaceae (Faboideae)          | <i>Desmodium varians</i>                              | slender tick-trefoil  |
| Fabaceae (Faboideae)          | <i>Glycine clandestina</i>                            |                       |
| Fabaceae (Faboideae)          | <i>Glycine tabacina</i>                               |                       |
| Fabaceae (Faboideae)          | <i>Swainsona behriana</i>                             | a Swainson-pea        |
| Fabaceae (Faboideae)          | <i>Zornia dyctiocarpa</i>                             |                       |
| Fabaceae (Mimosoideae)        | <i>Acacia decora</i>                                  | western golden wattle |
| Fabaceae (Mimosoideae)        | <i>Acacia falcata</i>                                 |                       |
| Fabaceae (Mimosoideae)        | <i>Acacia filicifolia</i>                             | fern-leaved wattle    |
| Fabaceae (Mimosoideae)        | <i>Acacia homalophylla</i> – <i>melvillei</i> complex | yarran                |
| Fabaceae (Mimosoideae)        | <i>Acacia implexa</i>                                 | hickory wattle        |
| Fabaceae (Mimosoideae)        | <i>Acacia linearifolia</i>                            | narrow-leaved wattle  |
| <b>Fabaceae (Mimosoideae)</b> | <b><i>Acacia</i> prob. <i>pendula</i></b>             | <b>weeping myall</b>  |
| Geraniaceae                   | <i>Geranium solanderi</i>                             | native geranium       |
| Lamiaceae                     | <i>Ajuga australis</i>                                | austral bugle         |
| Lamiaceae                     | <i>Mentha satuireioides</i>                           | native pennyroyal     |
| Linaceae                      | <i>Linum marginale</i>                                | native flax           |
| Loranthaceae                  | <i>Amyema quandang</i>                                |                       |
| Malvaceae                     | <i>Hibiscus sturtii</i>                               | hill hibiscus         |
| Malvaceae                     | <i>Sida corrugata</i>                                 | corrugated sida       |
| Malvaceae                     | <i>Sida filiformis</i>                                |                       |

| Family           | Scientific Name                                   | Common Names           |
|------------------|---------------------------------------------------|------------------------|
| Malvaceae        | <i>*Sida rhombifolia</i>                          | Paddys lucerne         |
| Malvaceae        | <i>Sida subspicata</i>                            |                        |
| Myoporaceae      | <i>Eremophila debilis</i>                         | amulla                 |
| Myrtaceae        | <i>Angophora floribunda</i>                       | rough-barked apple     |
| Myrtaceae        | <i>Eucalyptus blakelyi</i>                        | Blakelys red gum       |
| Myrtaceae        | <i>Eucalyptus crebra</i>                          | narrow-leaved ironbark |
| Myrtaceae        | <i>Eucalyptus dawsonii</i>                        | slaty box              |
| Myrtaceae        | <i>Eucalyptus moluccana</i>                       | grey box               |
| Myrtaceae        | <i>Eucalyptus punctata</i>                        | grey gum               |
| Myrtaceae        | <i>Eucalyptus tereticornis</i>                    | forest red gum         |
| Myrtaceae        | <i>Kunzea</i> sp. 'Mt Kaputar'                    |                        |
| Myrtaceae        | <i>Melaleuca decora</i>                           |                        |
| Nyctaginaceae    | <i>Boerhavia dominii</i>                          | tarvine                |
| Oleaceae         | <i>Notelaea microcarpa</i> var. <i>microcarpa</i> | native olive           |
| Oxalidaceae      | <i>Oxalis exilis</i>                              |                        |
| Oxalidaceae      | <i>Oxalis perennans</i>                           |                        |
| Pittosporaceae   | <i>Bursaria spinosa</i> subsp. <i>spinosa</i>     | native blackthorn      |
| Plantaginaceae   | <i>Plantago debilis</i>                           | native plantain        |
| Polygonaceae     | <i>Rumex brownii</i>                              | swamp dock             |
| Portulacaceae    | <i>Portulaca oleracea</i>                         | pigweed                |
| Rhamnaceae       | <i>Alphitonia excelsa</i>                         | red ash                |
| Rubiaceae        | <i>Asperula conferta</i>                          | common woodruff        |
| Rubiaceae        | <i>*Richardia stellaris</i>                       |                        |
| Rubiaceae        | <i>Opercularia aspera</i>                         | coarse stinkweed       |
| Rubiaceae        | <i>Psydrax odorata</i>                            | shiny-leaved canthium  |
| Scrophulariaceae | <i>Veronica plebeia</i>                           | trailing speedwell     |
| Solanaceae       | <i>Solanum brownii</i>                            | violet nightshade      |
| Solanaceae       | <i>Solanum cinereum</i>                           | Narrawa burr           |
| Solanaceae       | <i>Solanum opacum</i>                             | green-berry nightshade |
| Solanaceae       | <i>Solanum prinophyllum</i>                       | forest nightshade      |
| Stackhousiaceae  | <i>Stackhousia monogyna</i>                       | creamy candles         |
| Stackhousiaceae  | <i>Stackhousia viminea</i>                        | slender stackhousia    |

# **APPENDIX B**

## **Fauna Species List**

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## Appendix B – Fauna Species List

**Table 1** of this appendix consists of fauna species opportunistically recorded during the surveys of the Proposed Modification Areas. Fauna field surveys for this component of the project comprised recording of fauna habitat features, as well as opportunistic recording of all fauna species encountered during flora field surveys (see Section 2.3 of the main report).

**Table 2** provides a list of all fauna species recorded during surveys of the additional biodiversity offset area (as per Section 6.3.2 of the main report).

All threatened species are indicated in **bold** type.

Any species that could not be identified to the species taxonomic level are denoted in the following manner:

- sp.            specimens that were identified to genus level only; and
- ?             specimens for which identification was uncertain.

The following abbreviations or symbols are used in the list:

asterisk (\*) denotes species not indigenous to the study area;

MAR        Listed marine species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);

MIG        Listed migratory species under the EPBC Act;

V            Vulnerable under the *Threatened Species Conservation Act 1995* (TSC Act) or EPBC Act; and

E            Endangered under the TSC Act or EPBC Act.

Birds recorded were identified using descriptions in Slater *et al.* (2003) and the scientific and common name nomenclature and taxonomy adopted by Birds Australia. Reptiles recorded were identified using keys and descriptions in Cogger (2000), Swan *et al.* (2004), Weigel (1990) and Wilson & Swan (2003) and the scientific and common name nomenclature and taxonomy adopted by Cogger (2000).

Amphibians recorded were identified using keys and descriptions in Cogger (2000), Robinson (1998), Anstis (2002) and Barker *et al.* (1995) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Strahan and Van Dyck (2008), Churchill (2008) and Menkhorst & Knight (2004) and the scientific and common name nomenclature of Strahan and Van Dyck (2008), for non-bat species and Churchill (2008) for bats.

**Table 1 – Fauna Species Recorded from Proposed Modification Areas**

| Scientific Name                    | Common Name              | Conservation Status |           |
|------------------------------------|--------------------------|---------------------|-----------|
|                                    |                          | TSC Act             | EPBC Act  |
| BIRDS                              |                          |                     |           |
| Anatidae                           |                          |                     |           |
| <i>Chenonetta jubata</i>           | Australian wood duck     |                     | MIG       |
| <i>Anas superciliosa</i>           | Pacific black duck       |                     | MIG       |
| Podicipedidae                      |                          |                     |           |
| <i>Tachybaptus novaehollandiae</i> | Australasian grebe       |                     |           |
| Columbidae                         |                          |                     |           |
| <i>Ocyphaps lophotes</i>           | crested pigeon           |                     |           |
| Ardeidae                           |                          |                     |           |
| <i>Egretta novaehollandiae</i>     | white-faced heron        |                     |           |
| Threskiornithidae                  |                          |                     |           |
| <i>Threskiornis molucca</i>        | Australian white ibis    |                     | MAR       |
| Accipitridae                       |                          |                     |           |
| <i>Aquila audax</i>                | wedge-tailed eagle       |                     | MIG       |
| Falconidae                         |                          |                     |           |
| <i>Falco cenchroides</i>           | nankeen kestrel          |                     | MAR & MIG |
| Cacatuidae                         |                          |                     |           |
| <i>Cacatua roseicapillus</i>       | galah                    |                     |           |
| <i>Cacatua galerita</i>            | sulphur-crested cockatoo |                     |           |
| Psittacidae                        |                          |                     |           |
| <i>Platycercus eximius</i>         | eastern rosella          |                     |           |
| Halcyonidae                        |                          |                     |           |
| <i>Dacelo novaeguineae</i>         | laughing kookaburra      |                     |           |
| Maluridae                          |                          |                     |           |
| <i>Malurus cyaneus</i>             | superb fairy-wren        |                     |           |
| Acanthizidae                       |                          |                     |           |
| <i>Acanthiza chrysorrhoa</i>       | yellow-rumped thornbill  |                     |           |
| Pardalotidae                       |                          |                     |           |
| <i>Pardalotus striatus</i>         | striated pardalote       |                     |           |
| Meliphagidae                       |                          |                     |           |
| <i>Manorina melanocephala</i>      | noisy miner              |                     |           |
| <i>Philemon corniculatus</i>       | noisy friarbird          |                     |           |
| Artamidae                          |                          |                     |           |
| <i>Cracticus nigrogularis</i>      | pied butcherbird         |                     |           |
| <i>Gymnorhina tibicen</i>          | Australian magpie        |                     |           |
| Corvidae                           |                          |                     |           |
| <i>Corvus coronoides</i>           | Australian raven         |                     |           |
| Monarchidae                        |                          |                     |           |
| <i>Grallina cyanoleuca</i>         | magpie-lark              |                     | MAR       |
| Hirundinidae                       |                          |                     |           |
| <i>Hirundo neoxena</i>             | welcome swallow          |                     | MAR       |
| Sturnidae                          |                          |                     |           |
| <i>*Sturnus vulgaris</i>           | common starling          |                     |           |

| Scientific Name        | Common Name           | Conservation Status |          |
|------------------------|-----------------------|---------------------|----------|
|                        |                       | TSC Act             | EPBC Act |
| Estrildidae            |                       |                     |          |
| Taeniopygia guttata    | zebra finch           |                     |          |
| MAMMALS                |                       |                     |          |
| Vombatidae             |                       |                     |          |
| Vombatus ursinus       | common wombat         |                     |          |
| Macropodidae           |                       |                     |          |
| Macropus giganteus     | eastern grey kangaroo |                     |          |
| Wallabia bicolor       | swamp wallaby         |                     |          |
| Canidae                |                       |                     |          |
| *Vulpes vulpes         | fox                   |                     |          |
| Bovidae                |                       |                     |          |
| *Bos taurus            | cow                   |                     |          |
| Leporidae              |                       |                     |          |
| *Oryctolagus cuniculus | rabbit                |                     |          |

**Table 2 – Fauna Species Recorded from Additional Biodiversity Offset Area**

| Scientific Name                    | Common Name              | Conservation Status |          |
|------------------------------------|--------------------------|---------------------|----------|
|                                    |                          | TSC Act             | EPBC Act |
| BIRDS                              |                          |                     |          |
| Anatidae                           |                          |                     |          |
| <i>Chenonetta jubata</i>           | Australian wood duck     |                     | MIG      |
| <i>Anas gracilis</i>               | grey teal                |                     | MIG      |
| <i>Anas superciliosa</i>           | Pacific black duck       |                     | MIG      |
| <i>Tachybaptus novaehollandiae</i> | Australasian grebe       |                     |          |
| Columbidae                         |                          |                     |          |
| <i>Phaps chalcoptera</i>           | common bronzewing        |                     |          |
| <i>Ocyphaps lophotes</i>           | crested pigeon           |                     |          |
| Podargidae                         |                          |                     |          |
| <i>Podargus strigoides</i>         | tawny frogmouth          |                     |          |
| Aegothelidae                       |                          |                     |          |
| <i>Aegotheles cristatus</i>        | Australian owl-nightjar  |                     |          |
| Ardeidae                           |                          |                     |          |
| <i>Egretta novaehollandiae</i>     | white-faced heron        |                     |          |
| Accipitridae                       |                          |                     |          |
| <i>Aquila audax</i>                | wedge-tailed eagle       |                     | MIG      |
| Charadriidae                       |                          |                     |          |
| <i>Vanellus miles</i>              | masked lapwing           |                     | MIG      |
| Cacatuidae                         |                          |                     |          |
| <i>Cacatua galerita</i>            | sulphur-crested cockatoo |                     |          |
| Psittacidae                        |                          |                     |          |
| <i>Glossopsitta pusilla</i>        | little lorikeet          | V                   |          |
| <i>Platycercus eximius</i>         | eastern rosella          |                     |          |
| <i>Psephotus haematonotus</i>      | red-rumped parrot        |                     |          |
| Halcyonidae                        |                          |                     |          |

| Scientific Name                           | Common Name                                      | Conservation Status |           |
|-------------------------------------------|--------------------------------------------------|---------------------|-----------|
|                                           |                                                  | TSC Act             | EPBC Act  |
| <i>Dacelo novaeguineae</i>                | laughing kookaburra                              |                     |           |
| <i>Todiramphus macleayi</i>               | forest kingfisher                                |                     | MAR       |
| <i>Merops ornatus</i>                     | rainbow bee-eater                                |                     | MAR & MIG |
| <b>Climacteridae</b>                      |                                                  |                     |           |
| <i>Corombates leucophaea</i>              | white-throated treecreeper                       |                     |           |
| <i>Climacteris picumnus victoriae</i>     | <b>brown treecreeper<br/>(eastern subsp.)</b>    | <b>V</b>            |           |
| <b>Maluridae</b>                          |                                                  |                     |           |
| <i>Malurus cyaneus</i>                    | superb fairy-wren                                |                     |           |
| <b>Acanthizidae</b>                       |                                                  |                     |           |
| <i>Gerygone fusca</i>                     | western gerygone                                 |                     |           |
| <i>Gerygone albogularis</i>               | white-throated gerygone                          |                     |           |
| <i>Acanthiza nana</i>                     | yellow thornbill                                 |                     |           |
| <i>Acanthiza chrysorrhoa</i>              | yellow-rumped thornbill                          |                     |           |
| <b>Pardalotidae</b>                       |                                                  |                     |           |
| <i>Pardalotus punctatus</i>               | spotted pardalote                                |                     |           |
| <i>Pardalotus striatus</i>                | striated pardalote                               |                     |           |
| <b>Meliphagidae</b>                       |                                                  |                     |           |
| <i>Lichenostomus chrysops</i>             | yellow-faced honeyeater                          |                     |           |
| <i>Lichenostomus leucotis</i>             | white-eared honeyeater                           |                     |           |
| <i>Lichenostomus penicillatus</i>         | white-plumed honeyeater                          |                     |           |
| <i>Manorina melanocephala</i>             | noisy miner                                      |                     |           |
| <i>Phylidonyris niger</i>                 | white-cheeked honeyeater                         |                     |           |
| <i>Melithreptus brevirostris</i>          | brown-headed honeyeater                          |                     |           |
| <i>Melithreptus albogularis</i>           | white-throated honeyeater                        |                     |           |
| <i>Philemon corniculatus</i>              | noisy friarbird                                  |                     |           |
| <b>Pomatostomidae</b>                     |                                                  |                     |           |
| <i>Pomatostomus temporalis temporalis</i> | <b>grey-crowned babbler<br/>(eastern subsp.)</b> | <b>V</b>            |           |
| <i>Pomatostomus superciliosus</i>         | white-browed babbler                             |                     |           |
| <b>Campephagidae</b>                      |                                                  |                     |           |
| <i>Coracina novaehollandiae</i>           | black-faced cuckoo-shrike                        |                     | MAR       |
| <b>Pachycephalidae</b>                    |                                                  |                     |           |
| <i>Pachycephala rufiventris</i>           | rufous whistler                                  |                     |           |
| <i>Colluricincla harmonica</i>            | grey shrike-thrush                               |                     |           |
| <b>Artamidae</b>                          |                                                  |                     |           |
| <i>Cracticus nigrogularis</i>             | pied butcherbird                                 |                     |           |
| <i>Gymnorhina tibicen</i>                 | Australian magpie                                |                     |           |
| <i>Strepera graculina</i>                 | pied currawong                                   |                     |           |
| <b>Rhipiduridae</b>                       |                                                  |                     |           |
| <i>Rhipidura albiscapa</i>                | grey fantail                                     |                     |           |
| <i>Rhipidura leucophrys</i>               | willie wagtail                                   |                     |           |
| <b>Laniidae</b>                           |                                                  |                     |           |
| <i>Corvus coronoides</i>                  | Australian raven                                 |                     |           |
| <b>Monarchidae</b>                        |                                                  |                     |           |
| <i>Grallina cyanoleuca</i>                | magpie-lark                                      |                     | MAR       |

| Scientific Name                                   | Common Name                 | Conservation Status |          |
|---------------------------------------------------|-----------------------------|---------------------|----------|
|                                                   |                             | TSC Act             | EPBC Act |
| <b>Corcoracidae</b>                               |                             |                     |          |
| <i>Corcorax melanorhamphos</i>                    | white-winged chough         |                     |          |
| <b>Petroicidae</b>                                |                             |                     |          |
| <i>Microeca leucophaea</i>                        | jacky winter                |                     |          |
| <i>Eopsaltria australis</i>                       | eastern yellow robin        |                     |          |
| <b>Megaluridae</b>                                |                             |                     |          |
| <i>Zosterops lateralis</i>                        | silveryeye                  |                     | MAR      |
| <b>Hirundinidae</b>                               |                             |                     |          |
| <i>Hirundo nigricans</i>                          | tree martin                 |                     | MAR      |
| <b>Estrildidae</b>                                |                             |                     |          |
| <i>Taeniopygia bichenovii</i>                     | double-barred finch         |                     |          |
| <b><i>Stagonopleura guttata</i></b>               | <b>diamond firetail</b>     | <b>V</b>            |          |
| <b>REPTILES</b>                                   |                             |                     |          |
| <b>Gekkonidae</b>                                 |                             |                     |          |
| <i>Underwoodisaurus milii</i>                     | thick-tailed gecko          |                     |          |
| <b>Scincidae</b>                                  |                             |                     |          |
| <i>Ctenotus robustus</i>                          | stripped skink              |                     |          |
| <i>Egernia modesta</i>                            |                             |                     |          |
| <i>Egernia striolata</i>                          | tree skink                  |                     |          |
| <i>Lampropholis guichenoti</i>                    | garden skink                |                     |          |
| <i>Saproscincus mustelina</i>                     | weasel skink                |                     |          |
| <b>AMPHIBIANS</b>                                 |                             |                     |          |
| <b>Myobatrachidae</b>                             |                             |                     |          |
| <i>Uperoleia laevisgata</i>                       | smooth toadlet              |                     |          |
| <b>Hylidae</b>                                    |                             |                     |          |
| <i>Litoria latopalmata</i>                        | broad-palmed frog           |                     |          |
| <b>MAMMALS</b>                                    |                             |                     |          |
| <b>Phalangeridae</b>                              |                             |                     |          |
| <i>Trichosurus vulpecula</i>                      | common brushtail possum     |                     |          |
| <b>Macropodidae</b>                               |                             |                     |          |
| <i>Macropus giganteus</i>                         | eastern grey kangaroo       |                     |          |
| <i>Macropus rufogriseus</i>                       | red-necked wallaby          |                     |          |
| <b>Molossidae</b>                                 |                             |                     |          |
| <b><i>Mormopterus norfolkensis</i></b>            | <b>eastern freetail-bat</b> | <b>V</b>            |          |
| <i>Mormopterus planiceps</i>                      | southern freetail-bat       |                     |          |
| <i>Mormopterus "Species 2"</i>                    | freetail-bat                |                     |          |
| <i>Mormopterus "Species 4"</i>                    | freetail-bat                |                     |          |
| <i>Nyctinomus australis</i>                       | white-striped freetail-bat  |                     |          |
| <b>Vespertilionidae</b>                           |                             |                     |          |
| <b><i>Miniopterus schreibersii oceanensis</i></b> | <b>eastern bentwing-bat</b> | <b>V</b>            |          |
| <i>Nyctophilus sp</i>                             | unidentified long-eared bat |                     |          |
| <b><i>Chalinolobus dwyeri</i></b>                 | <b>large-eared pied bat</b> | <b>V</b>            | <b>V</b> |
| <i>Chalinolobus gouldii</i>                       | Gould's wattled bat         |                     |          |
| <i>Chalinolobus morio</i>                         | chocolate wattled bat       |                     |          |

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| Scientific Name                     | Common Name             | Conservation Status |          |
|-------------------------------------|-------------------------|---------------------|----------|
|                                     |                         | TSC Act             | EPBC Act |
| <i>Scotorepens balstoni</i>         | inland broad-nosed bat  |                     |          |
| <i>Scotorepens orion</i>            | eastern broad-nosed bat |                     |          |
| <b><i>Vespadelus troughtoni</i></b> | <b>eastern cave bat</b> | <b>V</b>            |          |
| <i>Vespadelus darlingtoni</i>       | large forest bat        |                     |          |
| <i>Vespadelus pumilus</i>           | eastern forest bat      |                     |          |
| <i>Vespadelus vulturnus</i>         | little forest bat       |                     |          |
| <b>Canidae</b>                      |                         |                     |          |
| <i>*Vulpes vulpes</i>               | fox                     |                     |          |
| <b>Leporidae</b>                    |                         |                     |          |
| <i>*Lepus capensis</i>              | brown hare              |                     |          |

## **APPENDIX C**

### **Threatened Species Tables**

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## Appendix C – Threatened Species Tables

The following tables list all threatened species, endangered populations, TECs and EPBC Act listed marine and migratory species which were found to occur or have potential to occur within a 20 kilometre radius of the Proposed Modification Areas. These records have been collated from the literature review, including ecological database searches. An assessment of the potential for each of these records to occur within the Proposed Modification Areas has been made. This assessment is based on the known range and habitat requirements of each species, and comparison with the current understanding of the habitats of the Proposed Modification Areas. Further to this, indication is given as to whether a species requires further assessment of significance in accordance with the requirements of the EP&A Act, in the form of an Assessment of Significance (see **Appendix D**). Some species listed under the EPBC Act require further assessment under that Act. These have been assessed separately in **Appendix E**.

**Table 1 – Threatened Flora Species**

| Species                                              | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                | Reservation in the Region                                               | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                                                                                         | Detailed Assessment of Significance Required? |
|------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>THREATENED FLORA SPECIES</b>                      |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                        |                                                                         |                                                                                                                                                                                                                                                                                        |                                               |
| lobed blue-grass<br><i>Bothriochloa biloba</i>       | V (EPBC)            | Grows in woodlands and grasslands on poorer soils.                                                                                                                                                                                                                                                                                                                                                                                                                         | Regionally recorded across much of the central and upper Hunter Valley with fewer records in the lower Hunter but as far east as Maitland. This species was recorded within the grasslands of the Anvil Hill Project EA (Umwelt 2006). | This species is not known from any conservation reserves in the region. | There were no record of this species found from the Proposed Modification Areas, however they do contain potential habitat for this species. There are records of <i>Bothriochloa biloba</i> in grassland habitats of the Anvil Hill Project Study Area and in the broader local area. | Yes (see <b>Appendix E</b> )                  |
| Sandy Hollow commersonia<br><i>Commersonia rosea</i> | E (TSC)<br>E (EPBC) | Prostrate shrub 0.1-0.3 m high, producing trailing branches up to 60 cm long (Bell and Copeland 2004). Flowering has been observed in August, November, January and February (Bell and Copeland 2004). Occurs on skeletal sandy soils derived from Triassic Narrabeen sandstone, in scrub or heath vegetation (Bell and Copeland 2004). The species is believed to be fire-ephemeral, flowering and fruiting only after disturbance has occurred (Bell and Copeland 2004). | <i>Commersonia rosea</i> is only known from four sites in the Sandy Hollow district in the upper Hunter Valley (Bell and Copeland 2004). This species was recorded in the Anvil Hill Project EA (Umwelt 2006).                         | This species is not known from any conservation reserves in the region. | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                   | No                                            |

| Species                                         | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                        | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                   | Reservation in the Region                                                                                                                                                                                              | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|-------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Cynanchum elegans</i>                        | E (TSC)<br>E (EPBC) | The species has been recorded from rainforest gullies and scree slopes, but is thought to mainly occur at the ecotone between dry rainforest and sclerophyll forest or woodland (DECCW 2010). The species has been recorded in dry subtropical rainforest, littoral rainforest, coastal scrub, open forest and woodland and open scrub. | <i>Cynanchum elegans</i> is restricted to eastern NSW from Yabbra State Forest in the north to Gerroa in the south and Merriwa in the west (DECCW 2010). The Proposed Modification Areas occur within the known distribution of this species.             | Within the Hunter Valley <i>C. elegans</i> has been recorded in Wollemi and Goulburn River National Parks.                                                                                                             | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| finger panic grass<br><i>Digitaria porrecta</i> | E (TSC)<br>E (EPBC) | Native grassland, woodlands or open forest with a grassy understorey, on richer soils. Often found along roadsides and travelling stock routes where there is light grazing and occasional fire.                                                                                                                                        | Found in NSW and Queensland. In NSW, occurs on north-west slopes and plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. The Proposed Modification Areas occur outside the distribution of known records of this species. | This species is not known from any conservation reserves within the region.                                                                                                                                            | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| tricolour diuris<br><i>Diuris tricolor</i>      | V (TSC)             | Sclerophyll forest among grass, often with <i>Callitris</i> . Sandy soils, either on flats or small rises.                                                                                                                                                                                                                              | Muswellbrook LGA is the eastern limit of the known range and the only recorded occurrence in the Sydney Basin Bioregion. This species was recorded in the Anvil Hill Project EA (Umwelt 2006), as well as by Eastcoast Flora Survey 2009a).               | Tricolour diuris ( <i>Diuris tricolor</i> ) has been recorded within a conservation reserve(s) within the region (Briggs and Leigh 1996), however there are no records stating which reserve(s) the species occurs in. | This species was recorded in Proposed Modification Area 1. Potential habitat for this species occurs throughout the grassland and open grassy woodland habitats of the Proposed Modification Areas.                  | Yes (see <b>Appendix D</b> )                  |

| Species                                     | Legal Status        | Specific Habitat                                                                                                                                      | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                                       | Reservation in the Region                                               | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|---------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Diuris pedunculata</i>                   | E (TSC)<br>E (EPBC) | A terrestrial herb flowering August to September (Jones 1993). The species typically grows in moist grassy areas in sclerophyll forest (Jones 1993b). | <i>Diuris pedunculata</i> is known to occur from Port Jackson to Tenterfield in the North Coast, Central Coast and Northern Tablelands botanical subdivisions (Jones 1993b). The Proposed Modification Areas occur within the known distribution of this species.                                             | This species is not known from any conservation reserves in the region. | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| slaty red gum<br><i>Eucalyptus glaucina</i> | V (TSC)<br>V (EPBC) | This species grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.                                     | Found only on the north coast of NSW and in separate districts: near Casino (where it can be locally common) and further south, from Taree to Broke, west of Maitland. Scattered occurrences around Singleton. The Proposed Modification Areas occur slightly west of the known distribution of this species. | Belford NP                                                              | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                     | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                         | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                                                                                                                                                                                                    | Reservation in the Region                                         | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|---------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Pokolbin mallee<br><i>Eucalyptus pumila</i> | V (TSC)<br>V (EPBC) | The species occupies north-west-facing slopes derived from sandstone.                                                                                                                                                                                                                                    | Currently known only from a few small populations west of Pokolbin in the Hunter Valley. Historical records also exist for Wyong and Sandy Hollow, however, has not been recorded recently in these areas. The Proposed Modification Areas occur within the known distribution of this species.                                                                                                                                                                            | This species is not known to occur in any reserves in the region. | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| <i>Homoranthus darwinioides</i>             | V (TSC)<br>V (EPBC) | Grows in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand. | Rare in the central tablelands and western slopes of NSW, occurring from Putty to the Dubbo district. Found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo SF. Collected from Lee's Pinch, but not relocated at its original locality north of Mt Coricudgy above the headwaters of Widden Brook. Goonoo SF is established as a definite locality. Proposed Modification Areas occur east of the known distribution of this species. | Goulburn River NP                                                 | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                       | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                           | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                             | Reservation in the Region                                                                          | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|-------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Kennedia retrorsa</i>      | V (TSC)<br>V (EPBC) | A prostrate or climbing herb, with stems growing to 2 metres long flowering in spring (Gardner and James 2002). The preferred habitat of the species is variable, ranging from mountain sides to riparian zones, from sheltered forest to steep, exposed rocky ridgelines. | The species occurs chiefly on Mt Dangar and Goulburn River valley to near Putty (Gardner and James 2002). The Proposed Modification Areas occur within the known distribution of this species.                                                                                                      | Sites occur within Goulburn River and Wollemi National Parks and nearby private land (DECCW 2010). | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| <i>Olearia cordata</i>        | V (TSC)<br>V (EPBC) | Populations are typically small and scattered. Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges.                                                                                                                                               | A NSW endemic with a scattered distribution generally restricted to the south-western Hunter Plateau, eastern Colo Plateau, and the far north-west of the Hornsby Plateau near Wisemans Ferry east of Maroota. The Proposed Modification Areas occur within the broad distribution of this species. | Yengo NP<br>Wollemi NP                                                                             | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| <i>Ozothamnus tessellatus</i> | V (TSC)<br>V (EPBC) | Dry sclerophyll forest and woodlands.                                                                                                                                                                                                                                      | Restricted to a few locations north of Rylstone. The Proposed Modification Areas occur to the east of the known records of this species.                                                                                                                                                            | Goulburn River NP                                                                                  | This species was not recorded from the Proposed Modification Areas. There is no potential for the project to have a significant impact on this species.                                                              | No                                            |

| Species                            | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                                                                                                | Reservation in the Region                    | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                                                                                     | Detailed Assessment of Significance Required? |
|------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Lasiopetalum longistamineum</i> | V (TSC)<br>V (EPBC) | The species typically grows in rich alluvial deposits and flowers in spring. Little is known about this species' ecology or biology.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | This species occurs in the Mt Dangar – Gungal area within Upper Hunter and Muswellbrook LGAs. Three sites are recorded within Goulburn River NP. This species was recorded in the Anvil Hill Project EA (Umwelt 2006).                                                                                                                                                 | The species is known from Goulburn River NP. | This species has been recorded in the locality, however has not been recorded in the habitats of the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| <i>Philothea ericifolia</i>        | V (EPBC)            | Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Associated species include <i>Melaleuca uncinata</i> , <i>Eucalyptus crebra</i> , <i>E. rossii</i> , <i>E. punctata</i> , <i>Corymbia trachyphloia</i> , <i>Acacia triptera</i> , <i>A. burrowii</i> , <i>Beyeria viscosa</i> , <i>Philothea australis</i> , <i>Leucopogon muticus</i> and <i>Calytrix tetragona</i> . This species flowers in the spring and produces fruit from November to December. | This species is known only from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW. The records are scattered over a range of over 400 km between West Wyalong and the Pilliga Scrub. In the upper Hunter it grows on exposed rocky outcrops around Scone. The Proposed Modification Areas occur at the edge of the known distribution of this species. | Wingen Maid NR                               | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species.                                                               | No                                            |

| Species                                         | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                             | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                      | Reservation in the Region                                                                                                                                                                      | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|-------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| hawk weed<br><i>Picris evae</i>                 | V (TSC)<br>V (EPBC) | When this species occurs it is sporadically placed and occasional, occurring in black, dark grey, red-brown, or reddish medium clay to clay-loam. It is mostly found in eucalypt forest, <i>Dichanthium</i> grassland, roadsides and cultivated habitats, and is commonly associated with modified habitats. | The species is found on the north-western slopes and plains regions, from the northern point of Elsmore (east of Inverell) through to the south most point at Oxley Park (Tamworth) and to the east Dangar Falls in the Oxley Wild Rivers NP in the NSW Northern Tablelands. | This species is not known to occur in any reserves in the region.                                                                                                                              | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| Bodalla pomaderris<br><i>Pomaderris bodalla</i> | V (TSC)             | <i>Pomaderris bodalla</i> is a shrub 2-4 m high. The species occurs in moist open forest along sheltered gullies or along stream banks.                                                                                                                                                                      | Confined to the Nerrigundah and Brogo areas in the South Coast botanical subdivision and in the upper Hunter Valley near Muswellbrook. The Proposed Modification Areas occur within proximity to a disjunct population of this species in the Muswellbrook area.             | <i>Pomaderris bodalla</i> is in the conservation reserves of Kooraban National Park on the south coast, and in Wollemi National Park and Wingen Maid Nature Reserve in the north of its range. | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                         | Legal Status                        | Specific Habitat                                                                                                                                                                                                                       | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                                                                               | Reservation in the Region                                               | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                                                                     | Detailed Assessment of Significance Required? |
|---------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Pomaderris queenslandica</i> | E (TSC)                             | This species is found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.                                                                                                       | This species is widely scattered but not common in north-east NSW and in Queensland. It is only known from a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolatai, and also from several locations on the NSW North Coast. This species was recorded in the Anvil Hill Project EA (Umwelt 2006). | This species is not known from any conservation reserves in the region. | This species has been recorded in the locality, however has not been recorded in the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| <i>Pomaderris reperta</i>       | E (TSC)<br>PD CE (TSC)<br>CE (EPBC) | This species occupies woodland in association with <i>Eucalyptus crebra</i> , <i>E. blakelyi</i> , <i>Notelaea microcarpa</i> , and <i>Allocasuarina littoralis</i> . This species grows on a sandy loam on sandstone or conglomerate. | This species has been recorded from a small number of sites near Denman in the upper Hunter Valley (Muswellbrook local government area). This species is also known from the Wybong area. This species was recorded in the Anvil Hill Project EA (Umwelt 2006).                                                                                       | This species is not known from any conservation reserves in the region. | This species has been recorded in the locality, however has not been recorded in the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                                                 | Legal Status        | Specific Habitat                                                                                                                                                                                          | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                                                                                                                                                                                                                         | Reservation in the Region                                               | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                                                                                                           | Detailed Assessment of Significance Required? |
|-------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| leek orchid<br><i>Prasophyllum</i> sp.<br>Wybong (C.Phelps<br>ORG 5269) | CE (EPBC)           | This species generally occurs in grassy and scrubby habitats in open eucalypt woodland and grasslands.                                                                                                    | This species is endemic to NSW, from which there are only seven known populations from near NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield. It is not known to occur outside the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes bioregions. Its area of occupancy is estimated at 1.5km <sup>2</sup> . This species has been recorded within the approved project disturbance area by Eastcoast Flora Surveys (2009a). | This species is not known from any conservation reserves in the region. | This species was not recorded within the Proposed Modification Areas, however it has been recorded from the approved project disturbance area for the Mangoola Coal Project site. Potential habitat occurs throughout the grassland and open grassy woodland habitats of the Mangoola Coal Project site. | Yes (see Appendix E)                          |
| <i>Prostanthera cineolifera</i>                                         | V (TSC)<br>V (EPBC) | An erect, strongly aromatic shrub, growing to 1-4 m high and flowering September to October (Conn 1992). The species grows on exposed sandstone ridges usually on shallow or skeletal sands (DECCW 2010). | It is restricted to a few localities near Walcha, Scone and St Albans (DECCW 2010). The Proposed Modification Areas occur within the known distribution of this species.                                                                                                                                                                                                                                                                                                                        | Yengo NP<br>Oxley Wild Rivers NP                                        | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                                     | No                                            |

| Species                            | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                                                                                                                            | Reservation in the Region       | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Prostanthera cryptandroides</i> | V (TSC)<br>V (EPBC) | In the Denman-Gungal and Widden-Baerami Valley areas, this species occurs on rocky ridgelines on Narrabeen Group Sandstones in association with a range of communities. Associated communities include: Narrabeen Rocky Heath, Narrabeen Acacia Woodland, Narrabeen Exposed Woodland; Open Heath of <i>Calytrix tetragona</i> , <i>Leptospermum parviflorum</i> , <i>Isopogon dawsonii</i> ; and Open Scrubland of <i>Eucalyptus dwyeri</i> , <i>Baeckea densifolia</i> , <i>Dillwynia floribunda</i> , <i>Aotus ericoides</i> and <i>Hemigenia cunefolia</i> . This species flowers from September to May. | This species occurs in restricted areas but over a fairly broad range from the Lithgow and Sandy Hollow Districts into the Border Rivers/Gwydir Catchment and up into Queensland. Occurs in the Wollemi National Park and is likely to also occur within the Goulburn River National Park.<br>The Proposed Modification Areas occur within the known distribution of this species. | Wollemi NP                      | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| <i>Prostanthera discolor</i>       | V (TSC)<br>V (EPBC) | An erect, strongly aromatic shrub 0.6-3 m high, flowering September to October (Conn 1992). The species grows in dry sclerophyll forest in gullies (Conn 1992), often on rocky or well-drained alluvial substrates.                                                                                                                                                                                                                                                                                                                                                                                         | It is restricted to a few localities from Bylong to the Baerami Valley within the Rylstone and Muswellbrook local government areas (DECCW 2010).<br>The Proposed Modification Areas occur within the known distribution of this species.                                                                                                                                           | Goulburn River NP<br>Wollemi NP | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                     | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                       | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                                  | Reservation in the Region                                               | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                                                           | Detailed Assessment of Significance Required? |
|---------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| mintbush<br><i>Prostanthera stricta</i>     | V (EPBC)<br>V (TSC) | This species grows in sandy/alluvium soils near watercourses, and is associated with sclerophyll forests (Botanic Gardens Trust 2010)                                                                                                                                  | It is distributed in the Widden Valley district in the botanical subdivisions of the Central Tablelands and the Central- western Tablelands (Botanic Gardens Trust 2010).                                                                                                | This species is not known to occur in any reserves in the region.       | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species.                                     | No.                                           |
| <i>Pterostylis gibbosa</i>                  | E (TSC)<br>E (EPBC) | All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.                                                                                                                                                              | Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).                                                                                                        | This species is not known to occur in any reserves in the region.       | This species was not recorded from the Proposed Modification Areas. There is no potential for the project to have a significant impact on this species.                                                                                                  | No                                            |
| austral toadflax<br><i>Thesium australe</i> | V (TSC)<br>V (EPBC) | This species occurs in grassland or grassy woodland and is often found in damp sites in association with kangaroo grass ( <i>Themeda australis</i> ). This species is a root parasite that takes water and some nutrient from other plants, especially kangaroo grass. | This species is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania, Queensland and in eastern Asia. This species was recorded in the locality by Umwelt (2007-8). | This species is not known from any conservation reserves in the region. | This species has been recorded in grassland habitats in the vicinity of the Proposed Modification Areas, however not within them. Potential habitat occurs throughout the grassland and open grassy woodland habitats of the Mangoola Coal Project site. | Yes (see <b>Appendices D and E</b> )          |

| Species                                 | Legal Status        | Specific Habitat                                                                        | Distribution in relation to Proposed Modification Areas                                                                                                                                                                                                       | Reservation in the Region                                                          | Occurrence in Proposed Modification Areas and Potential for Significant Impact                                                                                                                                       | Detailed Assessment of Significance Required? |
|-----------------------------------------|---------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <i>Rulingia procumbens</i>              | V (TSC)             | Grows in sandy sites, often along roadsides.                                            | Endemic to NSW, mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Recent collections made from the Upper Hunter region. The Proposed Modification Areas occur to the east of known records of this species. | This species is not known to occur in any conservation reserves within the region. | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| Wollemi pine<br><i>Wollemia nobilis</i> | E (TSC)<br>E (EPBC) | Occurs in warm-temperate rainforest and rainforest margins on remote sandstone canyons. | This species has a distribution which is limited to remote canyons of Wollemi NP to the north-west of Sydney. The Proposed Modification Areas do not occur within the known range of this species.                                                            | Wollemi NP                                                                         | This species was not recorded from the Proposed Modification Areas. These areas do not support typical habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

Key:

- CE: critically endangered
- E: endangered
- EPBC: *Environment Protection and Biodiversity Conservation Act 1999*
- LGA: Local Government Area
- NR: Nature Reserve
- NP: National Park
- PD: preliminary determination
- TSC: *Threatened Species Conservation Act 1995*
- V: vulnerable

**Table 2 – Threatened Ecological Communities**

| <b>THREATENED ECOLOGICAL COMMUNITIES (TECs)</b>                                                            |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                |                                                      |
|------------------------------------------------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Species</b>                                                                                             | <b>Legal Status</b> | <b>Specific Habitat</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Distribution in relation to the Study Area</b>                                                                                                                                                                                                                                                                                   | <b>Reservation in the Region</b>                                                                                                                                                                                                                          | <b>Occurrence in Study Area and Potential for Significant Impact</b>                                                                                                                                                                                                                                                           | <b>Detailed Assessment of Significance Required?</b> |
| Central Hunter Ironbark - Spotted Gum - Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions | EEC (TSC)           | This community typically occurs in the form of an open forest or woodland and occurs upon Permian sediments of the Hunter Valley. The canopy layer is dominated by grey box ( <i>Eucalyptus moluccana</i> ), broad-leaved ironbark ( <i>Eucalyptus fibrosa</i> ), slaty red gum ( <i>Eucalyptus glaucina</i> ), forest red gum ( <i>Eucalyptus tereticornis</i> ) and narrow-leaved ironbark ( <i>Eucalyptus crebra</i> ).                                                                                                                                                                                                     | This community occurs in the NSW North Coast and Sydney Basin Bioregions. It has been recorded in the LGAs of Cessnock, Muswellbrook and Singleton but is thought to occur in other areas of the NSW North Coast and Sydney Basin Bioregion. This community is not known to occur in the region of the Proposed Modification Areas. | Belford NP.                                                                                                                                                                                                                                               | No areas of this EEC were found to occur within the Proposed Modification Areas. There is no potential for the project to impact on this EEC.                                                                                                                                                                                  | No                                                   |
| Hunter Valley Weeping Myall Woodland in the Sydney Basin Bioregion                                         | EEC (TSC)           | A dense to open tree canopy up to 15 m tall, depending on disturbance and regrowth history. Most common tree is weeping myall ( <i>Acacia pendula</i> ), may occur with narrow-leaved ironbark ( <i>Eucalyptus crebra</i> ), cooba ( <i>Acacia salicina</i> ) and/or trees of the <i>Acacia homalophylla</i> – <i>Acacia melvillei</i> complex. Understorey shrubs may include stiff canthium ( <i>Psydrax odorata</i> ), sticky hopbush ( <i>Dodonaea viscosa</i> ), wilga ( <i>Geijera parviflora</i> ), native olive ( <i>Notelaea microphylla</i> var. <i>microphylla</i> ) and silver cassia ( <i>Senna zygophylla</i> ). | Currently known from parts of the Muswellbrook and Singleton LGAs, but may occur elsewhere, including the Upper Hunter LGA. This community was recorded in the Anvil Hill Project EA (Umwelt 2006).                                                                                                                                 | No known natural remnants or populations of <i>Acacia pendula</i> occur in conservation areas, and only two stands, both part of the same population (at Jerrys Plains Cemetery), occur on community-owned land that is managed by a Council (Singleton). | A stand of this EEC occurs approximately 50 metres to the east of Proposed Modification Area 3. This population will not be disturbed as a result of the project. There are no records of this species within the Proposed Modification Areas. There is no potential for the project to have a significant impact on this EEC. | No                                                   |

| THREATENED ECOLOGICAL COMMUNITIES (TECs)                                              |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                            |                                                                                                                                                                                            |                                                                                                                                                 |                                               |
|---------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Species                                                                               | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Distribution in relation to the Study Area                                                                                                                                                                                                                 | Reservation in the Region                                                                                                                                                                  | Occurrence in Study Area and Potential for Significant Impact                                                                                   | Detailed Assessment of Significance Required? |
| Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions | VEC (TSC)    | Lower Hunter Valley Dry Rainforest typically occurs on Carboniferous sediments of the Barrington footslopes along the northern rim of the Hunter Valley Floor, where it occupies gullies and steep hillslopes with south facing aspects. It is generally found at elevations less than 300 m ASL with a mean annual rainfall less than 900 mm.                                                                                                                                                                                                                                                                           | Lower Hunter Valley Dry Rainforest has been recorded from the LGAs of Cessnock, Maitland and Port Stephens, and is also likely to occur or have occurred in Muswellbrook, Singleton, Upper Hunter and Dungog.                                              | This VEC is not known from any conservation reserves in the region.                                                                                                                        | No areas of this VEC were found to occur within the Proposed Modification Areas. There is no potential for the project to impact on this VEC.   | No                                            |
| Weeping Myall – Coobah – Scrub Wilga Shrubland                                        | CEEC (EPBC)  | This CEEC consists of a woodland of weeping myall ( <i>Acacia pendula</i> ) with coobah ( <i>Acacia salicina</i> ) and scrub wilga ( <i>Geijera salicifolia</i> ). yarran ( <i>Acacia omalophylla</i> ) and stiff canthium ( <i>Psydrax odoratum</i> ) are also present in the small tree/shrub layer. The ground stratum is dense and primarily grassy. Grasses include kangaroo grass ( <i>Themeda triandra/australis</i> ), wallaby grass ( <i>Austrodanthonia</i> spp.), snow grass ( <i>Poa sieberiana</i> ) and barbed wire grass ( <i>Cymbopogon refractus</i> ). Some exotic grasses have also invaded the site. | The CEEC occurs in a small stand on heavy, brown clay soil at Jerrys Plains in the Hunter Valley, in the South Hunter Province of the Sydney Basin Bioregion.<br><br>The Proposed Modification Areas occur outside of the known distribution of this CEEC. | No known natural remnants or populations of <i>Acacia pendula</i> occur in conservation areas. There are no known occurrences of this CEEC within the conservation reserves of the region. | No areas of this CEEC were found to occur within the Proposed Modification Areas. There is no potential for the project to impact on this CEEC. | No                                            |

| THREATENED ECOLOGICAL COMMUNITIES (TECs)                                                |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                  |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                              |                                               |
|-----------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Species                                                                                 | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Distribution in relation to the Study Area                                                                                                                                                                                       | Reservation in the Region                                                                                              | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                                                                | Detailed Assessment of Significance Required? |
| White Box - Yellow Box - Blakelys Red Gum Grassy Woodland and Derived Native Grasslands | CEEC (EPBC)  | This CEEC can occur as either woodland or derived grassland (grassy woodland from which trees have been removed). Groundlayer consists of native tussock grasses and herbs, and a sparse, scattered shrub layer. White box ( <i>Eucalyptus albens</i> ), yellow box ( <i>E. melliodora</i> ), or Blakelys red gum ( <i>E. blakelyi</i> ), dominate, where trees remain. Sites dominated by other tree species that do not have white box, yellow box, or Blakelys red gum as co-dominants are not considered to be part of the community, except in the Nandewar bioregion. In the Nandewar Bioregion, grey box ( <i>E. moluccana</i> or <i>E. microcarpa</i> ) may also be dominant or co-dominant in the community. | This CEEC occurs along the western slopes and tablelands of the Great Dividing Range from southern Queensland through NSW to central Victoria. The Proposed Modification Areas occur within the known distribution of this CEEC. | Wollemi NP<br>Manobalai NR<br>There are possible occurrences of this CEEC in the Goulburn River NP and Wingen Maid NR. | The floristic and structural composition of the vegetation communities within the Proposed Modification Areas were compared with those of this CEEC. This resulted in the finding that there are no remnants of vegetation within the Proposed Modification Areas which comprise this CEEC. There is no potential for the project to have a significant impact on this CEEC. | No.                                           |

| THREATENED ECOLOGICAL COMMUNITIES (TECs)           |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                 |                                                                                 |                                                                                                                                                                                                                                                                                                                                                                |                                               |
|----------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Species                                            | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Distribution in relation to the Study Area                                                                                                                                                                                                      | Reservation in the Region                                                       | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                                                  | Detailed Assessment of Significance Required? |
| White Box – Yellow Box – Blakelys Red Gum Woodland | EEC (TSC)    | This EEC is characterised by the presence or prior occurrence of white box, yellow box and/or Blakelys red gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include apple box ( <i>E. bridgesiana</i> ), red box ( <i>E. polyanthemus</i> ), candlebark ( <i>E. rubida</i> ), snow gum ( <i>E. pauciflora</i> ), Argyle apple ( <i>E. cinerea</i> ), brittle gum ( <i>E. mannifera</i> ), red stringybark ( <i>E. macrorhyncha</i> ), grey box ( <i>E. microcarpa</i> ), cabbage gum ( <i>E. amplifolia</i> ) and others. The understorey in intact sites is characterised by native grasses and a high diversity of herbs; the most commonly encountered include kangaroo grass ( <i>Themeda australis</i> ) poa tussock ( <i>Poa sieberiana</i> ), wallaby grasses ( <i>Austrodanthonia</i> spp.) and spear-grasses ( <i>Austrostipa</i> spp.). Shrubs are generally sparse or absent, though they may be locally common. | This EEC is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.<br><br>The Proposed Modification Areas occur within the known distribution of this EEC. | Goulburn River NP<br>Manobalai NR<br>Towarri NP<br>Wingen Maid NR<br>Wollemi NP | The floristic and structural composition of the vegetation communities within the Proposed Modification Areas were compared with those of this EEC. This resulted in the finding that there are no remnants of vegetation within the Proposed Modification Areas which comprise this EEC. There is no potential for the project to have an impact on this EEC. | No.                                           |

| THREATENED ECOLOGICAL COMMUNITIES (TECs)          |              |                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                    |                                                                                                                                               |                                               |
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| Species                                           | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                               | Distribution in relation to the Study Area                                                                                                                                                                                                                                                                                                                                                                         | Reservation in the Region                                                                                                          | Occurrence in Study Area and Potential for Significant Impact                                                                                 | Detailed Assessment of Significance Required? |
| River-flat Eucalypt Forest on Coastal Floodplains | EEC (TSC)    | Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level. | Known from parts of the LGAs of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. | None known.                                                                                                                        | No areas of this EEC were found to occur within the Proposed Modification Areas. There is no potential for the project to impact on this EEC. | No                                            |
| Hunter Floodplain Red Gum Woodland                | EEC (TSC)    | This community occurs along the Hunter river and associated tributaries, on floodplains and associated floodplain rises. The communities are tall to very tall woodlands that are typically dominated by river red gum ( <i>Eucalyptus camaldulensis</i> ) and grow on alluvial soils.                                                                                                         | The community is known from the Maitland, Muswellbrook, Singleton and Upper Hunter LGAs but is predicted to occur in other areas of the Sydney and NSW North Coast bioregions.                                                                                                                                                                                                                                     | A very small area of this community is known to occur in Towarri NP near Scone.<br><br>Also in Singleton Military Area (ERM 2005). | No areas of this EEC were found to occur within the Proposed Modification Areas. There is no potential for the project to impact on this EEC. | No.                                           |

| THREATENED ECOLOGICAL COMMUNITIES (TECs)    |              |                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                     |                                                                                                                                              |                                                  |
|---------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Species                                     | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                     | Distribution in relation to the Study Area                                                                                                                                                                                                                                                                                                                                                      | Reservation in the Region                                           | Occurrence in Study Area and Potential for Significant Impact                                                                                | Detailed Assessment of Significance Required?    |
| Hunter Valley Foothills Slaty Gum Woodland  | VEC (TSC)    | This community generally occurs at the interface of Narrabeen sandstone and Permian sediments and grows in the form of a low to medium high woodland. The canopy layer of this community is dominated by grey box ( <i>Eucalyptus moluccana</i> ), narrow-leaved ironbark ( <i>Eucalyptus crebra</i> ) and slaty gum ( <i>Eucalyptus dawsonii</i> ). | Generally found in the Hunter Valley, all sites are within the Sydney Basin Bioregion. This community is known to occur in the LGAs of Singleton and Muswellbrook, but is thought to occur elsewhere in the Sydney Basin Bioregion. This community is comparable to the Slaty Box Woodland recorded within the proposed modification areas, as well as the Anvil Hill Project EA (Umwelt 2006). | This VEC is not known from any conservation reserves in the region. | The Slaty Box Woodland of the Proposed Modification Areas corresponds to this VEC. 5.4 hectares of this VEC will be impacted by the project. | A VEC does not require assessment under Part 3A. |
| Central Hunter Grey Box – Ironbark Woodland | EEC (TSC)    | This community generally occurs on Permian sediments in the Hunter Valley. This community is typically identified on slopes and undulating hills and forms a woodland or open forest. Typical canopy layer species are inclusive of narrow-leaved ironbark ( <i>Eucalyptus crebra</i> ) and grey box ( <i>Eucalyptus moluccana</i> ).                | This community is distributed throughout the NSW North Coast and Sydney Basin Bioregion. It has been recorded from the LGAs of Muswellbrook, Singleton and Cessnock, but may occur elsewhere in the Sydney Basin Bioregion. The Proposed Modification Areas occur within its distribution.                                                                                                      | This EEC is not known from any conservation reserves in the region. | The Ironbark Woodland Complex of the Proposed Modification Areas corresponds to this EEC. This EEC will be impacted by the project.          | Yes (see <b>Appendix D</b> )                     |

Key: ASL – Above sea level

TSC = *Threatened Species Conservation Act 1995*

NR = Nature Reserve

EEC = Endangered Ecological Community

CEEC = Critically Endangered Ecological Community

VEC= vulnerable ecological community

NP = National Park

EPBC = *Environment Protection and Biodiversity Conservation Act 1999*

**Table 3 – Endangered Flora Populations**

| ENDANGERED FLORA POPULATIONS                                           |              |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                               |                                               |
|------------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Species                                                                | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                               | Reservation in the Region                                                                                                                                                                                                                                         | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                 | Detailed Assessment of Significance Required? |
| weeping myall<br><i>Acacia pendula</i> in the Hunter Catchment         | EP (TSC)     | Grows on major river floodplains on heavy clay soils, sometimes as the dominant species and forming low open woodlands. Within the Hunter catchment it typically occurs on heavy soils, sometimes at the margins of small floodplains, but also in more undulating locations remote from floodplains, such as at Jerrys Plains. | There are 17 confirmed and four unconfirmed naturally occurring remnants of the <i>A. pendula</i> population in the Hunter catchment. These range as far east as Warkworth, and west of Sandy Hollow. <i>Acacia pendula</i> is not known to occur naturally further north than the Muswellbrook-Wybong area.<br><br>This EP was recorded within the Anvil Hill Project EA (Umwelt 2006), outside, although close to the Proposed Modification Areas. | No known natural remnants or populations of <i>Acacia pendula</i> occur on land zoned for conservation and only two stands, both part of the same population (at Jerrys Plains Cemetery), occur on community-owned land that is managed by a Council (Singleton). | A stand of this EEC occurs approximately 50 metres to the east of Proposed Modification Area 3. This population will not be disturbed as a result of the project. There are no records of this species within the Proposed Modification Areas. There is no potential for the project to have a significant impact on this EP. | No                                            |
| tiger orchid<br><i>Cymbidium canaliculatum</i> in the Hunter Catchment | EP (TSC)     | This species occurs within dry sclerophyll forests and woodlands of tablelands and western slopes, growing in hollows of trees. It is usually found occurring singly or as a single clump, typically between two and six metres above the ground.                                                                               | The population of <i>Cymbidium canaliculatum</i> in the Hunter Catchment is at the south-eastern limit of the geographic range for this species.<br><br>This EP was recorded within the Anvil Hill Project EA (Umwelt 2006).                                                                                                                                                                                                                         | Wollemi NP<br>Goulburn River NP                                                                                                                                                                                                                                   | No records of this species occur within the Proposed Modification Areas, however suitable habitats are present for this species to occur. There is no potential for this project to comprise a significant impact on this EP.                                                                                                 | No                                            |

| ENDANGERED FLORA POPULATIONS                                             |              |                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                     |                                                                                                                                                                                                                        |                                               |
|--------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Species                                                                  | Legal Status | Specific Habitat                                                                                                                                                                                         | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                   | Reservation in the Region                                                                           | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                          | Detailed Assessment of Significance Required? |
| river red gum<br><i>Eucalyptus camaldulensis</i> in the Hunter Catchment | EP (TSC)     | This endangered population may occur with <i>Eucalyptus tereticornis</i> , <i>Eucalyptus melliodora</i> , <i>Casuarina cunninghamiana</i> subsp. <i>cunninghamiana</i> and <i>Angophora floribunda</i> . | The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River. It has been recorded in the LGAs of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter. The Proposed Modification Areas occur within the known distribution of this endangered population. | This species is not known from any conservation reserves in the region.                             | No records of this species occur within the Proposed Modification Areas and no suitable habitats are present for this species to occur. There is no potential for the project to have a significant impact on this EP. | No                                            |
| tricolour diuris<br><i>Diuris tricolor</i> in Muswellbrook LGA           | EP (TSC)     | Sclerophyll forest among grass, often with <i>Callitris</i> . Sandy soils, either on flats or small rises.                                                                                               | This endangered population is only known from a small number of locations within the Hunter Valley, including Jerrys Plains, Edderton, Wybong, Appletree Creek, Warkworth and Appletree Flat. This EP was recorded within the Anvil Hill Project EA (Umwelt 2006), as well as within the Proposed Modification Areas.                                                    | There are no records of <i>Diuris tricolor</i> from a conservation reserve in the Hunter Catchment. | This species was recorded in Proposed Modification Area 1. Potential habitat for <i>Diuris tricolor</i> occurs throughout the grassland and grassy woodland habitats of the Proposed Modification Areas.               | Yes (see <b>Appendix D</b> )                  |

| ENDANGERED FLORA POPULATIONS                                                 |              |                                                                                                                         |                                                                                                                                                                                                                                             |                                                                                                                             |                                                                                                                                                                                                                                                                                                                                 |                                               |
|------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Species                                                                      | Legal Status | Specific Habitat                                                                                                        | Distribution in relation to Study Area                                                                                                                                                                                                      | Reservation in the Region                                                                                                   | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                   | Detailed Assessment of Significance Required? |
| <i>Leionema lamprophyllum</i> subsp. <i>obovatum</i> in the Hunter Catchment | EP (TSC)     | The Hunter Catchment population occurs near Pokolbin, where it is found on a rocky cliff line in a dry eucalypt forest. | The Hunter Catchment population of <i>L. lamprophyllum</i> subsp. <i>obovatum</i> is currently found at one location within Pokolbin State Forest. The Proposed Modification Areas occur outside the currently known range of this species. | There are no records of <i>L. lamprophyllum</i> subsp. <i>obovatum</i> from a conservation reserve in the Hunter Catchment. | The Proposed Modification Areas contain potential habitat for this species, however all known records in the Hunter Catchment occur about 50 km to the east of the Proposed Modification Areas. This species is unlikely to occur, and therefore there is no potential for the project to have a significant impact on this EP. | No                                            |

Key: TSC = *Threatened Species Conservation Act 1995*  
EP = Endangered Population

**Table 4 – Threatened Fauna Species**

| Species                                                 | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                   | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                         | Reservation in the Region                                         | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                             | Detailed Assessment of Significance Required? |
|---------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>REPTILES</b>                                         |                     |                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                |                                                                   |                                                                                                                                                                                                           |                                               |
| pink-tailed worm-lizard<br><i>Aprasia parapulchella</i> | V (EPBC)<br>V (TSC) | Commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites. Inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by kangaroo grass ( <i>Themeda australis</i> ). | Known only from the Central and Southern Tablelands and the South Western Slopes of NSW. Records are concentrated around the Canberra region, while other populations have been found in Cooma, Yass, Bathurst, Albury and West Wyalong. The Proposed Modification Areas occur outside the known distribution of this species. | This species is not known to occur in any reserves in the region. | The Proposed Modification Areas are outside the known distribution of this species and the habitats are not suitable. There is no potential for the project to have a significant impact on this species. | No                                            |
| Rosenbergs goanna<br><i>Varanus rosenbergi</i>          | V (TSC)             | Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Individuals require large areas of habitat.                                                                                                                                                                                        | Occurs on the Sydney Sandstone in Wollemi NP to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. The Proposed Modification Areas occur outside the known distribution of this species.                      | Wollemi NP<br>Yengo NP                                            | The Proposed Modification Areas are outside the known distribution of this species and the habitats are not suitable. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                                | Legal Status | Specific Habitat                                                                                                                                                                                                                         | Distribution in relation to Study Area                                                                                                                                                                                                                                                                             | Reservation in the Region                                         | Occurrence in Study Area and Potential for Significant Impact                                                                                                         | Detailed Assessment of Significance Required? |
|--------------------------------------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| pale-headed snake<br><i>Hoplocephalus bitorquatus</i>  | V (TSC)      | Found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. Favours streamside areas, particularly in drier habitats.                                                  | A patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah. The Proposed Modification Areas occur within the known distribution of this species.                                                         | This species is not known to occur in any reserves in the region. | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| broad-headed snake<br><i>Hoplocephalus bungaroides</i> | E (TSC)      | Nocturnal. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer. | The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. The Proposed Modification Areas occur just outside the known distribution of this species. | Wollemi NP<br>Yengo NP                                            | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                            | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                          | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                       | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                         | Detailed Assessment of Significance Required? |
|----------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>AMPHIBIANS</b>                                  |                     |                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                         |                                                                                                                                                                       |                                               |
| green and golden bell frog<br><i>Litoria aurea</i> | E (TSC)<br>V (EPBC) | Occurs amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber, including grassland, cropland and modified pastures. Breeds in still or slow flowing waterbodies with some vegetation such as <i>Typha</i> spp. and <i>Eleocharis</i> spp.  | NSW North Coast near Brunswick Heads, southwards along the NSW Coast to Victoria where it extends into east Gippsland.<br>The Proposed Modification Areas occur west of the inland limit of this species' known distribution.                                                                                                                                                                                | This species is not known from any conservation reserves in the region. | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |
| Booroolong frog <i>Litoria booroolongensis</i>     | E (TSC)             | Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.<br>Shelter under rocks or amongst vegetation near the ground on the stream edge. | The Booroolong frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from the Northern Tablelands and is now rare throughout most of the remainder of its range. Most recent records are from the south-west slopes of NSW.<br>The Proposed Modification Areas occur within the known range of this species. | Mount Royal NP                                                          | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                         | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                            | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                             | Detailed Assessment of Significance Required? |
|-------------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| giant barred frog<br><i>Mixophyes iteratus</i>  | E (TSC)      | This species forages and lives amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams.                                                                               | Coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold.                                                                                                                                                                                                               | This species is not known to occur in any reserves in the region.       | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                     | No                                            |
| <b>BIRDS</b>                                    |              |                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                   |                                                                         |                                                                                                                                                                                                           |                                               |
| bush stone-curlew<br><i>Burhinus grallarius</i> | E (TSC)      | This species inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. The bush stone-curlew is largely nocturnal, being especially active on moonlit nights. It nests on the ground in a scrape or small bare patch laying two eggs in spring and early summer. | The bush stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however, and in the south-east it is either rare or extinct throughout its former range.<br><br>The Proposed Modification Areas occur within the known distribution of this species. | This species is not known from any conservation reserves in the region. | The Proposed Modification Areas are outside the known distribution of this species and the habitats are not suitable. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                     | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Distribution in relation to Study Area                                                                                                                                                                                                                                                             | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                  | Detailed Assessment of Significance Required? |
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| mallefowl<br><i>Leipoa ocellata</i>         | E (TSC)<br>V (EPBC) | Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300-450 mm mean annual rainfall) areas. Less frequently found in other eucalypt woodlands. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy, dense and variable shrub and herb layers.                                                                                                                                                                        | Recorded mainly from the southern half of the western NSW, from the Pilliga forest, south-west to the Griffith and Wentworth districts, excluding the southern Riverina.                                                                                                                           | This species is not known to occur in any reserves in the region.       | The Proposed Modification Areas do not contain suitable habitat for this species and is outside of its known distribution. There is no potential for the project to have a significant impact on this species. | No                                            |
| freckled duck<br><i>Stictonetta naevosa</i> | V (TSC)             | This species prefers permanent freshwater swamps and creeks with heavy growth of cumbungi, lignum or tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. This species generally rests in dense cover during the day, usually in deep water. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. The nests are usually located in dense vegetation at or near water level. | The freckled duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. This species may also occur as far as coastal NSW and Victoria during such times.<br><br>The Proposed Modification Areas occur within the known distribution of this species. | This species is not known from any conservation reserves in the region. | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                          | No                                            |

| Species                                                 | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                                              | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                                                                                                  | Detailed Assessment of Significance Required? |
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| black-necked stork<br><i>Ephippiorhynchus asiaticus</i> | E (TSC)      | Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | This species is widespread across coastal northern and eastern Australia, becoming uncommon further south into NSW, and rarely found south of Sydney.                                                                                                                                                                                                                                                                                                               | This species is not known to occur in any reserves in the region.       | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                                                                                                                                                                                          | No                                            |
| square-tailed kite<br><i>Lophoictinia isura</i>         | V (TSC)      | This species is usually recorded within 300 kilometres of the coast (Hollands 2003). This kite is found in a variety of timbered habitats including dry woodlands and open forests, showing a particular preference for timbered watercourses (DECCW 2010). Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs (DECCW 2010). This species appears to occupy large hunting ranges of more than 100 km <sup>2</sup> (DECCW 2010). It is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage (DECCW 2010). | The square-tailed kite ( <i>Lophoictinia isura</i> ) ranges along coastal and sub coastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems (DECCW 2010).<br>The Proposed Modification Areas occur within the known distribution of this species. | This species is not known from any conservation reserves in the region. | This species was not recorded within the Proposed Modification Areas during surveys. The potential habitats present would only account for a very minor component of the habitat range for any individual of this species within the local area, and there will be minimal disturbance to these habitats as part of the project. As such, the project will not result in a significant impact on this species. | No                                            |

| Species                            | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                                                           | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                     | Detailed Assessment of Significance Required? |
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| osprey<br><i>Pandion haliaetus</i> | V (TSC)      | Habitat for this species includes inshore coastal and estuarine waters, and occasionally inland rivers and lakes (Debus 2001). This species feeds mainly on fish, however also takes crustaceans, reptiles, small mammals or birds (Debus 2001). Breeding occurs from July to September and nests are often in dead trees and on headlands and rocky islands (Hollands 2003). Nests are re-used for many years (Hollands 2003), and are usually within one kilometre of the ocean (DECCW 2010). | The osprey ( <i>Pandion haliaetus</i> ) has a distribution along the majority of the eastern coastline, however is absent from Tasmania and rare in Victoria (Debus 2001). It is common around the northern coast, especially on rocky shorelines, islands and reefs (DECCW 2010). The species is uncommon to rare or absent from closely settled parts of south-eastern Australia.<br><br>The Proposed Modification Areas occur west of the known distribution of this species. | This species is not known from any conservation reserves in the region. | There is no foraging habitat for this coastal species within the Proposed Modification Areas. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                        | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                         | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                       | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                     | Detailed Assessment of Significance Required? |
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| red goshawk<br><i>Erythroriorchis radiatus</i> | E (TSC)<br>V (EPBC) | In NSW, preferred habitat is mixed tropical rainforest Melaleuca Swamp Forest and Open Eucalypt Forest along coastal rivers, often in rugged terrain (DECCW 2010). It favours patches of dense forest interspersed with open woodland or cleared land and often hunts along forest edges and ecotones (DECCW 2010). Habitats are generally close to permanent bodies of freshwater, nest sites being only up to 1 kilometre away from such water bodies. | The red goshawk ( <i>Erythroriorchis radiatus</i> ) has been recorded from across northern Australia, south through eastern Queensland to far north-east NSW. The species is very rare in NSW. Most records are from the Clarence River Catchment, with a few about the lower Richmond and Tweed Rivers (DECCW 2010). The Proposed Modification Areas occur south of the known distribution of this species. | This species is not known from any conservation reserves in the region. | The Proposed Modification Areas are situated outside the known range of this species and the habitats present are not consistent with the preferred habitats of this species. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                    | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| grey falcon<br><i>Falco hypoleucos</i>     | V (TSC)      | It is usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast, and also occurs near wetlands where surface water attracts prey (DECCW 2010). The species is found in timbered lowland plains, particularly acacia shrublands, crossed by tree-lined watercourses (Garnett and Crowley 2000). It hunts far out into treeless areas and frequents tussock grasslands and open woodland, especially in winter (Garnett and Crowley 2000). | The grey falcon ( <i>Falco hypoleucos</i> ) occurs in arid and semi-arid Australia, including the Murray-Darling basin, Eyre basin, central Australia and Western Australia where there is average annual rainfall of less than 500 mm (Garnett and Crowley 2000). Within NSW the species is found within the Murray-Darling basin and is occasionally recorded east of the Great Dividing Range (DECCW 2010). The Proposed Modification Areas occur within the known distribution of this species. | This species is not known from any conservation reserves in the region. | The Proposed Modification Areas are situated outside the known range of this species and the habitats present are not consistent with the preferred habitats of this species. There is no potential for the project to have a significant impact on this species.    | No                                            |
| spotted harrier<br><i>Circus assimilis</i> | V (TSC)      | Their habitat of choice is open grassy woodland, grassland, inland riparian woodland and shrub steppe. Although mostly associated with native grasslands it has also been identified in agricultural farmland. Their nest is made in a tree and composed of sticks.<br><br>Individuals of this species are sparsely distributed throughout Australia and occur as a single population.                                                                                                                                                              | The spotted harrier can be found throughout mainland Australia except for areas of dense forest on the coast, escarpments and ranges and rarely ever in Tasmania.                                                                                                                                                                                                                                                                                                                                   | This species is not known to occur in reserves in the region.           | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                           | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                     | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                                     | Reservation in the Region                                               | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| little eagle<br><i>Hieraaetus morphnoides</i>     | V (TSC)      | This species is typically identified in open eucalypt forests, woodlands and open woodlands, and other areas where prey are plentiful. The nest in tall living trees within remnant patches. This species occurs as a single population within Australia.                                                                                                                                                                            | The little eagle is distributed throughout mainland Australia except for the most densely forested parts of the Great Dividing Range escarpment.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), and has been listed since that record.                                                                                                                                                                                       | Lake Glenbawn SCA<br>Barrington Tops NP<br>Mt Royal NP<br>Tuggolo SF    | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| red-backed button-quail<br><i>Turnix maculosa</i> | V (TSC)      | This species inhabits grasslands, woodlands and cropped lands of warm temperate areas that annually receive 400 mm or more of summer rain (DECCW 2010). It appears to prefer sites near water, including grasslands and sedgeland near creeks, swamps and springs, and wetlands. Breeding is usually in dense grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter (DECCW 2010). | In Australia, the species has a largely coastal and sub-coastal range from the Kimberley region, Western Australia, through the Northern Territory, Queensland and NSW (DECCW 2010). In NSW, the majority records are from the North Coast Bioregion with a small number of records south as far as Sydney. Three outlying records are known from western NSW.<br><br>The Proposed Modification Areas occur within the known distribution of this species. | This species is not known from any conservation reserves in the region. | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                                                | No                                            |

| Species                                                   | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                 | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                  | Reservation in the Region                                                           | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                           | Detailed Assessment of Significance Required? |
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| Australian painted snipe<br><i>Rostratula australis</i>   | E (TSC)      | Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.                                                                                                                                                                                                     | In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin.                                                                                                                                                                 | This species is not known to occur in any reserves in the region.                   | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                                                   | No                                            |
| gang-gang cockatoo<br><i>Callocephalon fimbriatum</i>     | V (TSC)      | In summer this species occurs in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter this species moves to drier more open eucalypt forests and woodlands. It favours old growth trees for nesting and roosting.                                                 | In NSW this species occurs from the south east coast to the Hunter region and inland to the Central Tablelands and South-west Slopes. The Proposed Modification Areas occur within the known distribution of this species.                                                                                              | Barrington Tops NP<br>Goulburn River NP<br>Wollemi NP<br>Yengo NP                   | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species.    | No                                            |
| glossy black-cockatoo<br><i>Calyptrorhynchus lathamii</i> | V (TSC)      | Habitat for this species includes forests on low-nutrient soils, specifically those containing key <i>Allocasuarina</i> feed species. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae. Breeding occurs in autumn and winter, with large hollows required. | The glossy black-cockatoo has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith. This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP<br>Mount Royal NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |

| Species                                                                                | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                       | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                            | Reservation in the Region                                                        | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| varied sittella<br><i>Daphoenositta chrysoptera</i>                                    | V (TSC)      | The varied sittella can typically be found in eucalypt forests and woodlands, especially of rough-barked species and mature smooth-barked gums with dead branches, it can also be identified in mallee and acacia woodlands. This species builds a cup shaped nest made of plant fibres and spiders webs which is placed at the canopy level in the fork of a living tree.             | The varied sittella is a sedentary species that inhabits the majority of mainland Australia with the exception of the treeless deserts and open grasslands. Its NSW distribution is basically continuous from the coast to the far west.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), and has been listed since that record.                                                      | Wallabadah NR<br>Barrington Tops NP<br>Tuggolo SF<br>Mernot SF<br>Mount Royal NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| grey-crowned babbler (eastern subspecies)<br><i>Pomatostomus temporalis temporalis</i> | V (TSC)      | Open box-gum woodlands on the slopes. Box-cypress-pine and open box woodlands on alluvial plains. Also found in acacia shrubland and adjoining areas. Feeds on invertebrates; forage on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses (DECCW 2010). Occupy territories from 1 to 50 hectares. | Occurs throughout northern and south-eastern Australia. In NSW, this species occurs on the western slopes of the Great Dividing Range and on the western plains reaching as far west as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Belford NP<br>Goulburn River NP<br>Wollemi NP<br>Yengo NP                        | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                                                            | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                           | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                               | Reservation in the Region                                                     | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                           | Detailed Assessment of Significance Required? |
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| brown treecreeper<br>(eastern subspecies)<br><i>Climacteris picumnus victoriae</i> | V (TSC)      | Typical habitat for this species includes drier forests, woodlands and scrubs with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas. This species prefers areas without a dense understorey. | This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | This species is known to occur in Goulburn River NP<br>Wollemi NP<br>Yengo NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |
| turquoise parrot<br><i>Neophema pulchella</i>                                      | V (TSC)      | This species lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. It nests in tree hollows, logs or posts, from August to December.                                                                                                        | The turquoise parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range.<br><br>This species was recorded within the Anvil Hill Project EA (Umwelt 2006).                                                                                                              | Goulburn River NP<br>Wollemi NP<br>Yengo NP                                   | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |

| Species                                         | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Distribution in relation to Study Area                                                                                                                                                                                                                                                           | Reservation in the Region                   | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                       | Detailed Assessment of Significance Required? |
|-------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| swift parrot<br><i>Lathamus discolor</i>        | E (TSC)<br>E (EPBC) | This species often visits box-ironbark forests, feeding on nectar and lerps. This species occupy areas where winter-flowering eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Preferred winter-flowering resources include swamp mahogany ( <i>Eucalyptus robusta</i> ), spotted gum ( <i>Corymbia maculata</i> ), red bloodwood ( <i>C. gummifera</i> ), Mugga ironbark ( <i>E. sideroxylon</i> ), and white box ( <i>E. albens</i> ).                                                                              | In NSW this species has been recorded from the western slopes region along the inland slopes of the Great Dividing Range, as well as forests along the coastal plains from southern to northern NSW.<br><br>The Proposed Modification Areas occur within the known distribution of this species. | Wollemi NP                                  | There is limited potential foraging resources for this species within the woodland habitats of the Proposed Modification Areas. Due to the migratory and highly mobile nature of this species, there is no potential for the habitat loss associated with the project to have a significant impact on this species. | No                                            |
| regent honeyeater<br><i>Anthochaera phrygia</i> | E (TSC)<br>E (EPBC) | Generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands. Key foraging species (typically winter-flowering species in the Hunter Valley) include mugga ironbark ( <i>Eucalyptus sideroxylon</i> ), yellow box ( <i>E. melliodora</i> ), Blakelys red gum ( <i>Eucalyptus blakelyi</i> ), white box ( <i>E. albens</i> ) and swamp mahogany ( <i>E. robusta</i> ). | Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.<br><br>The Proposed Modification Areas occur within the known distribution of this species.       | Goulburn River NP<br>Wollemi NP<br>Yengo NP | There is limited potential foraging resources for this species within the woodland habitats of the Proposed Modification Areas. Due to the migratory and highly mobile nature of this species, there is no potential for the habitat loss associated with the project to have a significant impact on this species. | No                                            |

| Species                                        | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                            | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                     | Reservation in the Region                  | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                           | Detailed Assessment of Significance Required? |
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| superb parrot<br><i>Polytelis swainsonii</i>   | V (EPBC)<br>V (TSC) | Habitats include Box-Gum, Box-Cypress Pine and Boree woodlands and River Red Gum Forest. Nest in hollows of large trees, often in colonies. May forage up to 10 kilometres from nesting sites, primarily in grassy box woodlands. Feeds in trees, understorey shrubs and on the ground for grass seeds and herbaceous plants, and, less commonly, fruit, flowers, nectar, insects and buds. | Occurs throughout eastern inland NSW, with a core breeding area bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Migrate north to the region of the upper Namoi and Gwydir Rivers in winter.<br>The Proposed Modification Areas occur within the known distribution of this species.                                                               | Not known.                                 | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species.    | No                                            |
| little lorikeet<br><i>Glossopsitta pusilla</i> | V (TSC)             | This species can be found in dry-open eucalypt forests and woodlands, and have been identified in remnant vegetation, old growth vegetation, logged forests, and roadside vegetation. The little lorikeet usually forages in small flocks, not always with birds of their own species. They nest in hollows, mostly in living smooth-barked apples.                                         | This species is distributed from just north of Cairns, around the east coast of Australia down to Adelaide.<br>In NSW this species is found from the coast to the western slopes of the Great Dividing Range, extending as far west as Albury, Dubbo, Parkes and Narrabri.<br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), and has been listed since that record. | Wallabadah NR<br>Mt Royal NP<br>Tuggolo SF | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |

| Species                                                                              | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                     | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                    | Reservation in the Region                                                          | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| painted honeyeater<br><i>Grantiella picta</i>                                        | V (TSC)      | Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.                                                                                                                                                                                                                                                                                                                                                                             | The greatest concentration of this species and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution.<br>The Proposed Modification Areas occur within the known distribution of this species.                                            | This species is not known to occur in any conservation reserves within the region. | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| black-chinned honeyeater (eastern subspecies)<br><i>Melithreptus gularis gularis</i> | V (TSC)      | Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark ( <i>Eucalyptus sideroxylon</i> ), White Box ( <i>Eucalyptus albens</i> ), Grey Box ( <i>Eucalyptus microcarpa</i> ), Yellow Box ( <i>Eucalyptus melliodora</i> ) and Forest Red Gum ( <i>Eucalyptus tereticornis</i> ). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. | The subspecies is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions. | Yengo NP<br>Wollemi NP                                                             | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                                                     | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                               | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                   | Reservation in the Region         | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| olive whistler<br><i>Pachycephala olivacea</i>                              | V (TSC)      | Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. Forage in trees and shrubs and on the ground.                                                                                                                                                                          | Inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria.                                                                                                      | Mt Royal NP<br>Barrington Tops NP | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                                                | No                                            |
| hooded robin (south-eastern form)<br><i>Melanodryas cucullata cucullata</i> | V (TSC)      | This species prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Hooded robins require structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses (DECCW 2010). | This form of the hooded robin is distributed throughout south-eastern Australia, from central Queensland to the Spencer Gulf, South Australia. This form occurs throughout NSW except for the north-west, where it intergrades with the northern form <i>M. cucullata picata</i> . This species was recorded in the Anvil Hill Project EA (Umwelt 2006). | Goulburn River NP<br>Wollemi NP   | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                  | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                               | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                          | Reservation in the Region                           | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| scarlet robin<br><i>Petroica boodang</i> | V (TSC)      | This robin can be found in woodlands and open forests from the coast through to inland slopes. The birds can sometimes be found on the eastern fringe of the inland plains in the colder months of the year. Woody debris and logs are both important structural elements of its habitat. It forages from low perches on invertebrates either on the ground or in woody debris or tree trunks. | The scarlet robin can be found in south-eastern Australia, from Tasmania to the southern end of Queensland, to western Victoria and south SA. In NSW it is found throughout the eastern areas of the state, no further than 500 km from the coast. This species was recorded in the Anvil Hill Project EA (Umwelt 2006), and has been listed since that record. | Wollemi NP                                          | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| flame robin<br><i>Petroica phoenicea</i> | V (TSC)      | This species is known to breed in moist eucalypt forests and woodlands. It can usually be seen on ridges and slopes in areas where there is an open understorey layer. This species migrates during the winter to more lowland areas such as grasslands where there are scattered trees, as well as open woodland of the inland slopes and plains.                                             | This robin is located in south-eastern Australia from the Queensland border to Tasmania and into Victoria as well as south-east SA.                                                                                                                                                                                                                             | Polblue CR<br>Stewarts Brook SF<br>Ben Halls Gap NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                          | Legal Status | Specific Habitat                                                                                                                                                                                                                                        | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                                                  | Reservation in the Region                   | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| speckled warbler<br><i>Chthonicola sagittata</i> | V (TSC)      | The speckled warbler occurs in eucalypt-dominated communities that have a grassy understorey, leaf litter and shrub cover, often on rocky ridges or in gullies.                                                                                         | Patchy distribution throughout south-eastern Queensland, eastern half of NSW and into Victoria, as far west as the Grampians.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area.                                                                                                                                                                                                                                     | Goulburn River NP<br>Wollemi NP<br>Yengo NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| diamond firetail<br><i>Stagonopleura guttata</i> | V (TSC)      | Habitat includes a range of eucalypt dominated communities with a grassy understorey, including woodland, forest and mallee. It appears that populations are unable to persist in areas where there are no vegetated remnants larger than 200 hectares. | The diamond firetail occurs through central and eastern NSW, north into southern and central Queensland and south through Victoria to South Australia. In NSW it mainly occurs west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain and the Hunter, Clarence, Richmond and Snowy River valleys.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Goulburn River NP<br>Wollemi NP             | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |

| Species                                   | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                        | Distribution in relation to Study Area                                                                                                                                                                                                 | Reservation in the Region                                                           | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                           | Detailed Assessment of Significance Required? |
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| masked owl<br><i>Tyto novaehollandiae</i> | V (TSC)      | This species is generally recorded from open forest habitat with sparse mid-storey but patches of dense, low ground cover. It is also recorded from ecotones between wet and dry eucalypt forest, along minor drainage lines and near boundaries between forest and cleared land.                                                                                                                                       | The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006)                                             | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops<br>NPMount Royal NP  | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |
| barking owl<br><i>Ninox connivens</i>     | V (TSC)      | Habitat for this species includes dry forests and woodlands, often in association with hydrological features such as rivers and swamps.                                                                                                                                                                                                                                                                                 | The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however it is most abundant in the tropical north. Most records for this species occur west of the Great Dividing Range.       | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP                   | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species.    | No                                            |
| powerful owl<br><i>Ninox strenua</i>      | V (TSC)      | The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It generally requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. | The powerful owl occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006). | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP<br>Mount Royal NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |

| Species                                                                                           | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                               | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                      | Reservation in the Region                                                                      | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                        | Detailed Assessment of Significance Required? |
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| sooty owl                                                                                         | V (TSC)             | Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Nests in very large tree hollows.                                                                                                                | Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands.                                                                                                                                                                                                              | Mt Royal NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP                                    | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| <b>MAMMALS</b>                                                                                    |                     |                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                             |                                                                                                |                                                                                                                                                                                                                                                                      |                                               |
| spotted-tailed quoll<br><i>Dasyurus maculatus</i>                                                 | V (TSC)<br>E (EPBC) | Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops. Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves. | In NSW the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with the highest densities occurring in the north east of the state. It occurs from the coast to the snowline and inland to the Murray River.<br><br>The Proposed Modification Areas occur within the known distribution of this species. | This species is known to occur in Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP. | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is no potential for the project to have a significant impact on this species. | No                                            |
| brush-tailed phascogale (southern Australian subspecies)<br><i>Phascogale tapoatafa tapoatafa</i> | V (TSC)             | Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.                                                                                                       | This species has a patchy distribution around the coast of Australia. In NSW it is more frequently found in forest on the Great Dividing Range in the north-east and south-east of the State. There are also a few records from central NSW.                                                                                | Mt Royal NP<br>Barrington Tops NP                                                              | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                                                                                | No                                            |

| Species                                          | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                           | Reservation in the Region                                                           | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                             | Detailed Assessment of Significance Required? |
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| common planigale<br><i>Planigale maculata</i>    | V (TSC)      | Common planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.                                                                                                                                                                                                                                                                                                                                                                                                               | Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its southern distribution limit on the NSW lower north coast.                                                                                                                                                                                                                                            | Barrington Tops NP                                                                  | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                     | No                                            |
| eastern pygmy possum<br><i>Cercartetus nanus</i> | V (TSC)      | Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.                                                                                                                                                                                                                                                                                              | This species is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes.                                                                                                                                                       | Wollemi NP<br>Yengo NP<br>Barrington Tops NP                                        | The Proposed Modification Areas do not support sufficient diversity and density of understorey flowering resources for this species. The project will not result in a significant impact on this species. | No                                            |
| koala<br><i>Phascolarctos cinereus</i>           | V (TSC)      | This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns. The species is known to feed on a large number of eucalypt and non-eucalypt species, however it tends to specialise on a small number in different areas. <i>Eucalyptus tereticornis</i> , <i>E. punctata</i> , <i>E. cypellocarpa</i> , <i>E. viminalis</i> , <i>E. microcorys</i> , <i>E. robusta</i> , <i>E. albens</i> , <i>E. camaldulensis</i> and <i>E. populnea</i> are some preferred species. | The koala has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west. It is known to occur along inland rivers on the western side of the Great Dividing Range. Tentative records of this species (through scats) were recorded in the Anvil Hill Project EA (Umwelt 2006). | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP<br>Mount Royal NP | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                     | No                                            |

| Species                                                   | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                                                                            | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                                            | Reservation in the Region                                                       | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                 | Detailed Assessment of Significance Required? |
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| parma wallaby<br><i>Macropus parma</i>                    | V (TSC)             | Preferred habitat for this species is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. It typically feeds at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day it shelters in dense cover.                                                      | Although it once occurred from north-eastern NSW to the Bega area in the southeast, its range is now confined to the coast and ranges of central and northern NSW.<br><br>The Proposed Modification Areas occur within the known distribution of this species.                                                                                                                                                                                                    | This species is known to occur in Yengo NP, Barrington Tops and Mount Royal NP. | This species generally favours habitats with a dense, shrubby understorey. The Proposed Modification Areas do not support such habitats. The project will not result in a significant impact on this species. | No                                            |
| brush-tailed rock-wallaby<br><i>Petrogale penicillata</i> | E (TSC)<br>V (EPBC) | This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. It browses on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. This species shelters or bask during the day in rock crevices, caves and overhangs and is most active at night. | Its distribution roughly followed the Great Dividing Range for 2500 km from the Grampians in West Victoria to Nanango in south-east Queensland, with outlying populations in coastal valleys and ranges to the east of the divide, and the slopes and plains as far west as Cobar in NSW and Injune (500km NW of Brisbane) in Queensland.<br><br>Tentative records of this species (through very old scats) were made in the Anvil Hill Project EA (Umwelt 2006). | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP               | The Proposed Modification Areas do not contain suitable habitat for this species. There is no potential for the project to have a significant impact on this species.                                         | No                                            |

| Species                                                 | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                              | Distribution in relation to Study Area                                                                                                                                                                                      | Reservation in the Region                    | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                            | Detailed Assessment of Significance Required? |
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| squirrel glider<br><i>Petaurus norfolcensis</i>         | V (TSC)             | Inhabits a variety of mature or old growth habitats, including box, box-ironbark woodlands, river red gum forest, and blackbutt-bloodwood forest with heath understorey. It prefers mixed species stands with a shrub or acacia mid-storey, and requires abundant tree hollows for refuge and nest sites.                                     | The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Wollemi NP<br>Yengo NP<br>Mount Royal NP     | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species.                                                                  | Yes (see <b>Appendix D</b> )                  |
| grey-headed flying-fox<br><i>Pteropus poliocephalus</i> | V (TSC)<br>V (EPBC) | This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. | Grey-headed flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.                                                                                  | Wollemi NP<br>Yengo NP<br>Barrington Tops NP | This species has not been recorded in the Mangoola Coal Project area despite extensive surveys over six years. There is very limited potential for this species to occur in the Proposed Modification Areas.                                                                                                                             | No                                            |
| eastern freetail-bat<br><i>Mormopterus norfolkensis</i> | V (TSC)             | This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.                                                                                                                                                       | The eastern freetail-bat is found along the east coast from south Queensland to southern NSW.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area.                         | Wollemi NP<br>Yengo NP<br>Barrington Tops NP | This species was not recorded in the Proposed Modification Areas, however was recorded in the additional biodiversity offset area. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |

| Species                                                            | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                           | Distribution in relation to Study Area                                                                                                                                                                                                                        | Reservation in the Region                                                           | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                                     | Detailed Assessment of Significance Required? |
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| eastern bentwing-bat<br><i>Miniopterus schreibersii oceanensis</i> | V (TSC)      | This species hunts in forested areas and uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings and other man-made structures. It forms discrete populations centered on a maternity cave that is used annually in spring and summer for the birth and rearing of young. | Eastern bentwing-bats occur along the east and north-west coasts of Australia.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area.                                                                          | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP<br>Mount Royal NP | This species was not recorded in the Proposed Modification Areas, however was recorded in the additional biodiversity offset area. There are no potential roosting caves for this species within the Proposed Modification Areas. This species likely utilises the habitats of the Proposed Modification Areas as part of a wider foraging range. | No                                            |
| eastern false pipistrelle<br><i>Falsistrellus tasmaniensis</i>     | V (TSC)      | Habitat for this species includes sclerophyll forest. It prefers wet habitats, with trees over 20 metres high, and generally roosts in tree hollows or trunks.                                                                                                                                                             | This species has a range from south eastern Queensland, through NSW, Victoria and into Tasmania, and occurs from the Great Dividing Range to the coast.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Goulburn River NP<br>Wollemi NP<br>Yengo NP<br>Barrington Tops NP                   | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species.                                                                           | Yes (see <b>Appendix D</b> )                  |
| little bentwing-bat<br><i>Miniopterus australis</i>                | V (TSC)      | Prefers moist eucalypt forest, rainforest or dense coastal banksia scrub. This species roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.                                                                          | Occurs in coastal north-eastern NSW and eastern Queensland.                                                                                                                                                                                                   | Wollemi NP                                                                          | This species was not recorded in the Proposed Modification Areas. There are no potential roosting caves for this species within the Proposed Modification Areas.                                                                                                                                                                                  | No                                            |

| Species                                                           | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                                                                            | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                                         | Reservation in the Region                    | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                           | Detailed Assessment of Significance Required? |
|-------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| greater broad-nosed bat<br><i>Scoteanax rueppellii</i>            | V (TSC)      | The greater broad-nosed bat appears to prefer moist environments such as moist gullies in coastal forests, or rainforest. They have also been found in gullies associated with wet and dry sclerophyll forests and open woodland. It roosts in hollows in tree trunks and branches and has also been found to roost in the roofs of old buildings.                          | The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 metres.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Wollemi NP<br>Yengo NP<br>Barrington Tops NP | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species. | Yes (see <b>Appendix D</b> )                  |
| yellow-bellied sheath-tail-bat<br><i>Saccolaimus flaviventris</i> | V (TSC)      | This species forages for insects, flies high and fast over the forest canopy, but lower in more open country. It forages in most habitats across its very wide range, with and without trees; and appears to defend an aerial territory. It roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to use mammal burrows. | The yellow-bellied sheath-tail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.                                                                    | Wollemi NP                                   | This species has not been recorded in the Mangoola Coal Project area despite extensive surveys over six years. There is very limited potential for this species to occur in the Proposed Modification Areas.                                                            | No                                            |

| Species                                          | Legal Status | Specific Habitat                                                                                                                                                                                                                                                                                                         | Distribution in relation to Study Area                                                                                                                                                                                                                                                                                                                                                                                           | Reservation in the Region       | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                                     | Detailed Assessment of Significance Required? |
|--------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| large-footed myotis<br><i>Myotis adversus</i>    | V (TSC)      | This species generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking its feet across the water surface.                       | The large-footed myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area.                                                                                                            | Wollemi NP                      | This species was not recorded in the Proposed Modification Areas. This species has potential to forage within the Proposed Modification Areas as part of a wider foraging range. There is the potential that loss of hollow-bearing trees could impact on this species.                                                                           | Yes (see <b>Appendix D</b> )                  |
| eastern cave bat<br><i>Vespadelus troughtoni</i> | V (TSC)      | This species is a cave-roosting bat that is usually found in dry open forest and woodland, near cliffs or rocky overhangs. It has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals, and is occasionally found along cliff-lines in wet eucalypt forest and rainforest. | The eastern cave bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area. | Goulburn River NP<br>Wollemi NP | This species was not recorded in the Proposed Modification Areas, however was recorded in the additional biodiversity offset area. There are no potential roosting caves for this species within the Proposed Modification Areas. This species likely utilises the habitats of the Proposed Modification Areas as part of a wider foraging range. | No                                            |

| Species                                                                        | Legal Status        | Specific Habitat                                                                                                                                                                                                                                                                                                                                  | Distribution in relation to Study Area                                                                                                                                                                                                                                       | Reservation in the Region                                                              | Occurrence in Study Area and Potential for Significant Impact                                                                                                                                                                                                                                                                                     | Detailed Assessment of Significance Required? |
|--------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| large-eared pied bat<br><i>Chalinolobus dwyeri</i>                             | V (TSC)<br>V (EPBC) | The large-eared pied bat is generally found in a variety of drier habitats, including dry sclerophyll forests and woodlands, however, it probably tolerates a wide range of habitats. It tends to roost in the twilight zones of mines and caves, generally in colonies or common groups.                                                         | This species has a distribution from south western Queensland to NSW from the coast to the western slopes of the Great Dividing Range.<br><br>This species was recorded in the Anvil Hill Project EA (Umwelt 2006), broadly across the area.                                 | Goulburn River NP<br>Wollemi NP<br>Yengo NP                                            | This species was not recorded in the Proposed Modification Areas, however was recorded in the additional biodiversity offset area. There are no potential roosting caves for this species within the Proposed Modification Areas. This species likely utilises the habitats of the Proposed Modification Areas as part of a wider foraging range. | No                                            |
| eastern long-eared bat (SE form)<br><i>Nyctophilus timoriensis timoriensis</i> | V (TSC)             | Inhabits a variety of vegetation types, including mallee, bull-oak and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. | Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species.<br><br>The Proposed Modification Areas occur within the known range of this species. | This species is not known to occur within any conservation reserves within the region. | This species has not been recorded in the Mangoola Coal Project area despite extensive surveys over six years. There is very limited potential for this species to occur in the Proposed Modification Areas.                                                                                                                                      | No                                            |

Notes

CR: Crown reserve  
E: endangered  
EPBC: *Environment Protection and Biodiversity Conservation Act 1999*  
LGA: Local Government Area  
MAR: marine  
MIG: migratory  
NR: Nature Reserve  
NP: National Park  
PD: preliminary determination  
SCA: state conservation area  
TSC: *Threatened Species Conservation Act 1995*  
V: vulnerable

**Table 5 – EPBC Act Listed Migratory Species**

| <b>Species</b>                                            | <b>Status</b>       | <b>Potential to Occur in Proposed Modification Areas</b>                                 |
|-----------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------|
| white-bellied sea-eagle<br><i>Haliaeetus leucogaster</i>  | Migratory<br>Marine | Moderate                                                                                 |
| white-throated needletail<br><i>Hirundapus caudacutus</i> | Migratory<br>Marine | Moderate                                                                                 |
| malleefowl<br><i>Leiopa ocellata</i>                      | Migratory           | Low                                                                                      |
| rainbow bee-eater<br><i>Merops ornatus</i>                | Migratory<br>Marine | High – Recorded from additional biodiversity offset area and Mangoola Coal Project area. |
| black-faced monarch<br><i>Monarcha melanopsis</i>         | Migratory<br>Marine | Low                                                                                      |
| satin flycatcher<br><i>Myiagra cyanoleuca</i>             | Migratory<br>Marine | High                                                                                     |
| regent honeyeater<br><i>Anthochaera phrygia</i>           | Migratory           | Low                                                                                      |
| great egret<br><i>Ardea alba</i>                          | Migratory<br>Marine | Low                                                                                      |
| cattle egret<br><i>Ardea ibis</i>                         | Migratory<br>Marine | Low                                                                                      |
| Latham's snipe<br><i>Gallinago hardwickii</i>             | Migratory<br>Marine | Low                                                                                      |
| painted snipe<br><i>Rostratula benghalensis s. lat</i>    | Migratory<br>Marine | Low                                                                                      |
| fork-tailed swift<br><i>Apus pacificus</i>                | Migratory<br>Marine | Moderate                                                                                 |
| swift parrot<br><i>Lathamus discolor</i>                  | Marine              | Low                                                                                      |

## **APPENDIX D**

### **Assessment of Significance – Part 3A of the EP&A Act**

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## Appendix D – Assessment of Significance - *Environmental Planning and Assessment Act 1979* (EP&A Act) Assessment

Threatened species, endangered populations, or threatened ecological communities (TECs) recorded during surveys and known to occur in the local area are listed in **Appendix C**, as are the results of the searches of the relevant ecological databases. These database searches provided lists of species, populations or TECs previously recorded within a 20 kilometre radius of the Proposed Modification Areas, or with potential habitat within that radius.

**Appendix C** provides information on each threatened species (including specific habitat, distribution and reservation) and provides assessments of the potential for an impact from the project. Those species considered to have reasonable potential to occur within the Proposed Modification Areas (based on known distribution and habitat requirements) and with reasonable potential to be impacted by the project are addressed in more detail in the 'Assessment of Significance' included in this appendix.

Part 3A of the EP&A Act requires an assessment of significance be prepared relating to the potential impacts of the project on listed threatened species, endangered populations or TECs. As a formal assessment method format is yet to be established for the Part 3A pathway, an assessment that applies the key principles of the Part 5A assessment is used here to assess the potential for the project to impact on threatened species, endangered populations or TECs within the Proposed Modification Areas.

An assessment of significance is provided below for those identified threatened species, endangered populations or TECs considered (within **Appendix C**) to have the potential to be impacted by the project. The list includes species which are the subject of recent Preliminary Determinations by the NSW Scientific Committee to list as threatened species under the TSC Act. A precautionary approach is taken in this report, and these entities have been assessed as though they are formally listed.

The following species, populations and TECs are assessed:

- Central Hunter Grey Box – Ironbark Woodland –EEC;
- tricolor diuris (*Diuris tricolor*) – vulnerable species and endangered population;
- glossy black-cockatoo (*Calyptorhynchus lathamii*) – vulnerable species;
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) – vulnerable species;
- turquoise parrot (*Neophema pulchella*) – vulnerable species;
- little lorikeet (*Glossopsitta pusilla*) – vulnerable species;
- masked owl (*Tyto novaehollandiae*) – vulnerable species;
- powerful owl (*Ninox strenua*) – vulnerable species;
- squirrel glider (*Petaurus norfolkensis*) – vulnerable species;
- eastern freetail-bat (*Mormopterus norfolkensis*) – vulnerable species;

- eastern false pipistrelle (*Falsistrellus tasmaniensis*) – vulnerable species;
- large-footed myotis (*Myotis adversus*) – vulnerable species; and
- greater broad-nosed bat (*Scoteanax rueppellii*) – vulnerable species.

Despite its recent listing, it is not necessary to provide a formal impact assessment for the Hunter Valley Footslopes Slaty Gum Woodland VEC. This is because the EP&A Act requires the assessment of critically endangered and endangered ecological communities, but not vulnerable ecological communities. The impact on this community has, however been considered in the development of an offset strategy for the project, due to the provision of habitat for threatened species in this community.

All species listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* requiring further assessment are considered in a separate assessment provided in **Appendix E**.

### **Central Hunter Grey Box – Ironbark Woodland EEC**

**a) *In relation to the regional distribution of the habitat of the endangered ecological community, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

Approximately 1.2 hectares of this EEC has been recorded within the Proposed Modification Area 2. It is expected that inundation of this area for the proposed raw water dam will impact on all of this vegetation community within the Proposed Modification Area. In relation to the regional distribution of this EEC, it is not likely that a significant area of known habitat will not be modified or removed, or isolated from currently interconnecting or proximate areas.

**b) *Whether the endangered ecological community, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This community is not known from any conservation reserves in the region. This is not likely to comprise adequate representation of this EEC in the conservation reserves of the region.

**c) *Whether the endangered ecological community is at the limit of its known distribution.***

This community occurs in the NSW North Coast and Sydney Basin Bioregions. It has been recorded from the LGAs of Muswellbrook, Singleton and Cessnock, but may occur elsewhere in the Sydney Basin Bioregion. The Proposed Modification Areas are near to the western limit of the known distribution of this EEC.

### **Tricolour diuris (*Diuris tricolor*)**

Tricolour diuris (*Diuris tricolor*) is listed as a vulnerable species under the TSC Act, while the population within the Muswellbrook Local Government Area (in which the Proposed Modification Areas occur) is listed under the TSC Act as an Endangered Population. Three individuals of this species were recorded within Proposed Modification Area 1 during surveys. There is potential habitat for this species in other grassland and open woodland habitats in the Proposed Modification Areas. This species was recorded in the Mangoola Coal Project Area as part of the Anvil Hill Project EA (Umwelt 2006) and from Eastcoast Flora Survey (2009a).

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**a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.**

Tricolour diuris (*Diuris tricolor*) was recorded (as three individuals) during surveys of the Proposed Modification Areas, and potential habitat for this species exists within very open woodland areas and Disturbed Grassland habitats within the Proposed Modification Areas. The project will result in the disturbance to 11.7 hectares of known and potential habitat for this species.

The project is not likely to impact the life cycle of this species such that a local viable population of the species is likely to be placed at risk of extinction.

**b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.**

The project will result in the disturbance of up to 11.7 hectares of known and potential habitat for this species. In relation to the regional distribution of habitat for this species, it is not likely that this impact will comprise a significant area. The project will not result in the fragmentation or isolation of currently connected habitats for this species, and it is not expected to provide a barrier to the transfer of the genetic material of any local population of *Diuris tricolor* within the Proposed Modification Areas or between other local populations.

**c) Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.**

This species has been recorded within a conservation reserve(s) within the region (Briggs and Leigh 1996), however there are no records stating which reserve(s) the species occurs in. It is inadequately reserved in conservation reserves in the region.

**d) Whether the species is at the limit of its known distribution.**

The Muswellbrook LGA is the eastern limit of the known range and the only recorded occurrence of this species in the Sydney Basin Bioregion. This species was recorded in the Anvil Hill Project EA (Umwelt 2006), within the approved project disturbance area (Eastcoast Flora Surveys 2009a), the Biodiversity Offset Areas and other parts of the local area.

**Tricolour diuris (*Diuris tricolor*) – Endangered Population in Muswellbrook LGA**

Tricolour diuris (*Diuris tricolor*) is listed as an endangered population within the Muswellbrook Local Government Area (in which the Proposed Modification Areas occurs) under the TSC Act. Three individuals comprising this population were recorded within the Proposed Modification Areas during surveys. There is potential habitat for this population in other grassland and open woodland habitats in the Proposed Modification Areas. This population was recorded in the Mangoola Coal Project Area as part of the Anvil Hill Project EA (Umwelt 2006) and from Eastcoast Flora Survey (2009a).

**a) Whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.**

Tricolour diuris (*Diuris tricolor*) was recorded during surveys of the Proposed Modification Areas, and potential habitat for this species exists within very open woodland areas and Disturbed Grassland habitats within the Proposed Modification Areas. The project will result in the disturbance of 11.7 hectares of known and potential habitat for this species, including

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the three known records within Proposed Modification Area 1. There are no records of this species within any of the other Proposed Modification Areas.

The project is not likely to impact the life cycle of this species such that the endangered population is likely to be placed at risk of extinction.

**b) In relation to the regional distribution of the habitat of the endangered population, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.**

The project will result in the disturbance of up to 11.7 hectares of known and potential habitat for this species. In relation to the regional distribution of habitat for this endangered population, it is not likely that this impact will comprise a significant area.

The project will not result in the fragmentation or isolation of currently connected habitats for this endangered population, and it is not expected to provide a barrier to the transfer of the genetic material of any local sub-population (comprising the endangered population) within the Proposed Modification Areas or between other local sub-populations.

**c) Whether the endangered population, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.**

The species that constitutes this endangered population has been recorded within a conservation reserve(s) within the region (Briggs and Leigh 1996), however there are no records stating which reserve(s) the species occurs in. It is inadequately reserved in conservation reserves in the region.

**d) Whether the endangered population is at the limit of its known distribution.**

The Muswellbrook LGA is the eastern limit of the known range and the only recorded occurrence of tricolor diuris in the Sydney Basin Bioregion. This population was recorded in the Mangoola Coal Project Area as part of the Anvil Hill Project EA (Umwelt 2006) and from Eastcoast Flora Survey (2009a).

**Glossy black-cockatoo (*Calyptorhynchus lathami*)**

The glossy black-cockatoo (*Calyptorhynchus lathami*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas support potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.**

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of foraging habitat and hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing only small amounts of foraging resources for this species. The project is likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

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- b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

- c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP, and Mount Royal NP. This is likely to comprise adequate representation in the conservation reserves of the region.

- d) *Whether the species is at the limit of its known distribution.***

This species has a sparse distribution along the east coast and adjacent inland areas from western Victoria to Rockhampton in Queensland. In NSW, it has been recorded as far inland as Cobar and Griffith. The Proposed Modification Areas are not at the limit of the known distribution of this species.

#### **Brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)**

The brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas supports potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

- a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of foraging habitat and hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

- b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a

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significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP. This is likely to comprise adequate representation within the conservation reserves of the region.

**d) *Whether the species is at the limit of its known distribution.***

This species occurs over central NSW, west of the Great Dividing Range and sparsely scattered to the east of the divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys. The Proposed Modification Areas are not at the limit of the known distribution of this species.

**Turquoise parrot (*Neophema pulchella*)**

The turquoise parrot (*Neophema pulchella*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas supports potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of foraging habitat and hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

**b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

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**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Goulburn River NP, Wollemi NP and Yengo NP. This is likely to comprise adequate representation within the conservation reserves of the region.

**d) *Whether the species is at the limit of its known distribution.***

The turquoise parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. The Proposed Modification Areas are not at the limit of the known distribution of this species.

**Little lorikeet (*Glossopsitta pusilla*)**

The little lorikeet (*Glossopsitta pusilla*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas support potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of foraging habitat and hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

**b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Wallabadah NR, Mt Royal NP and Tuggolo SF. This is not likely to comprise adequate representation within the conservation reserves of the region.

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**d) *Whether the species is at the limit of its known distribution.***

This species is distributed from just north of Cairns, around the east coast of Australia down to Adelaide. In NSW this species is found from the coast to the western slopes of the Great Dividing Range, extending as far west as Albury, Dubbo, Parkes and Narrabri. The Proposed Modification Areas are not at the limit of the known distribution of this species.

**Masked owl (*Tyto novaehollandiae*)**

The masked owl (*Tyto novaehollandiae*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas support potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

**b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP. This is likely to comprise adequate representation within the conservation reserves within the region.

**d) *Whether the species is at the limit of its known distribution.***

The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea. The Proposed Modification Areas are not at the limit of the known distribution for this species.

**Powerful owl (*Ninox strenua*)**

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The powerful owl (*Ninox strenua*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas support potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

**b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP, Barrington Tops NP and Mount Royal NP. This is likely to comprise adequate representation within the conservation reserves within the region.

**d) *Whether the species is at the limit of its known distribution.***

The powerful owl occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland. The Proposed Modification Areas are not at the limit of the known distribution for this species.

**Squirrel glider (*Petaurus norfolcensis*)**

The squirrel glider (*Petaurus norfolcensis*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas support potential habitat, including hollow-bearing trees that could be used by this species for nesting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

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This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

***b) In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

***c) Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Wollemi NP, Yengo NP and Mount Royal NP. This is likely to comprise adequate representation within the conservation reserves within the region.

***d) Whether the species is at the limit of its known distribution.***

The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. The Proposed Modification Areas is not at the limit of the known distribution for this species.

**Eastern freetail-bat (*Mormopterus norfolkensis*)**

The eastern freetail-bat (*Mormopterus norfolkensis*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas supports potential foraging habitat, including hollow-bearing trees that could be used by this species for roosting and breeding. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006), as well as within the additional biodiversity offset area.

***a) Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

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- b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

- c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

This species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP. This is likely to comprise adequate representation in the conservation reserves of the region.

- d) *Whether the species is at the limit of its known distribution.***

The eastern freetail-bat is found along the east coast from south Queensland to southern NSW. The Proposed Modification Areas is not at the limit of the known distribution of this species.

#### **Eastern false pipistrelle (*Falsistrellus tasmaniensis*)**

The eastern false pipistrelle (*Falsistrellus tasmaniensis*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas supports potential foraging habitat, including hollow-bearing trees that could be used by this species for roosting and breeding. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

- a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

- b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be

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present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

The species is known to occur in Goulburn River NP, Wollemi NP, Yengo NP and Barrington Tops NP. This is likely to comprise adequate representation in the conservation reserves of the region.

**d) *Whether the species is at the limit of its known distribution.***

This species has a range from south eastern Queensland, through NSW, Victoria and into Tasmania, and occurs from the Great Dividing Range to the coast. The Proposed Modification Areas is not at the limit of the known distribution of this species.

**Large-footed myotis (*Myotis adversus*)**

The large-footed myotis (*Myotis adversus*) is listed as a vulnerable species under the TSC Act. This species was recorded within the Proposed Modification Areas during surveys, and the Proposed Modification Areas supports potential foraging habitat, as well as hollow-bearing trees that could be used by this species for breeding and roosting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has been recorded within the Proposed Modification Areas, and it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide nesting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

**b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

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**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

The species is known to occur in Wollemi NP. This is not likely to comprise adequate representation in the conservation reserves of the region.

**d) *Whether the species is at the limit of its known distribution.***

The large-footed myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 kilometres inland, except along major rivers. The Proposed Modification Areas is not at the limit of the known distribution of this species.

**Greater broad-nosed bat (*Scoteanax rueppellii*)**

The greater broad-nosed bat (*Scoteanax rueppellii*) is listed as a vulnerable species under the TSC Act. This species was not recorded within the Proposed Modification Areas during surveys, however the Proposed Modification Areas supports potential habitat, including hollow-bearing trees that could be used by this species for breeding and roosting. This species was recorded in the general area as part of the Anvil Hill Project EA (Umwelt 2006).

**a) *Whether the life cycle of the species is likely to be disrupted such that a local viable population of the species is likely to be placed at risk of extinction.***

This species has not been recorded within the Proposed Modification Areas, however it has the potential to be impacted by loss of hollow-bearing trees. The project is expected to result in the loss of 6.6 hectares of woodland habitat containing foraging resources for this species. The project is also likely to result in the loss of up to 20 hollow-bearing trees that may provide breeding and roosting resources for this species. Avoidance of the loss of hollow-bearing trees will occur wherever possible, and all removed hollows will be replaced as part of the nest box program.

The project is not likely to impact on a local viable population of the species, such that it is likely to be placed at risk of extinction.

**b) *In relation to the regional distribution of the habitat of the threatened species, whether a significant area of known habitat is to be modified or removed, or isolated from currently interconnecting or proximate areas.***

The loss of 6.6 hectares of woodland vegetation and 5.1 hectares of grassland habitat within the Proposed Modification Areas is not likely to comprise the modification or removal of a significant area of known (or potential) habitat for this species. The loss of up to 20 hollow-bearing trees is not considered to be significant, given the similar resources likely to be present in the local area, and the commitment to replace these hollows. The project is not of a nature that will isolate potential habitat for this species from currently interconnecting or proximate areas, particularly given the existing highly fragmented nature of the majority of the vegetation in the Proposed Modification Areas and surrounding area.

**c) *Whether the species, or its habitat, are adequately represented in conservation reserves (or other similar protected areas) in the region.***

The species is known to occur in Wollemi NP, Yengo NP and Barrington Tops NP. This is likely to comprise adequate representation within the conservation reserves of the region.

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**d) *Whether the species is at the limit of its known distribution.***

The greater broad-nosed bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however it does not occur at altitudes above 500 metres. The Proposed Modification Areas is not at the limit of the known distribution for this species.

## **APPENDIX E**

### **Assessment of Significance – EPBC Act**

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## **Appendix E – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) requires the completion of an Assessment of Significance relating to the potential impacts of a project on listed matters of National Environmental Significance (NES). A search of the Department of Environment, Water, Heritage and the Arts (DEWHA) Protected Matters Database identified threatened and migratory species (EPBC Act listed) known to occur or considered likely to occur, on the basis of habitat modelling, within 20 kilometres of the Proposed Modification Areas. No EPBC Act listed endangered populations or threatened ecological communities (TECs) are known or have potential to occur within the Proposed Modification Areas.

*Bothriochloa biloba*, *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) and *Thesium australe* have been recorded within the local area, and are considered to have the potential to occur within the Proposed Modification Areas.

Of the 13 migratory species identified from the database search, four species were found to have moderate to high potential to occur within the Proposed Modification Areas, and therefore were targeted for further assessment to determine the significance of any impacts associated with the project. These species are the white-bellied sea-eagle (*Haliaeetus leucogaster*), white-throated needletail (*Hirundapus caudacutus*), rainbow bee-eater (*Merops ornatus*), satin flycatcher (*Myiagra cyanoleuca*) and fork-tailed swift (*Apus pacificus*). Of these, none have been recorded within the Proposed Modification Areas. Those species with low potential to occur within the Proposed Modification Areas have not been assessed.

An Assessment of Significance (according to the significant impact criteria for each matter of NES) is provided below for those matters of NES identified within the Proposed Modification Areas, or considered to be potentially impacted by the project (as assessed within **Appendix C**).

### **Critically Endangered Species**

The critically endangered *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) has not been recorded within the Proposed Modification Areas, however it has been considered in this assessment, as a result of the presence of potential habitat. An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for this species.

**A ‘population of a species’ is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered species, occurrences include, but are not limited to:**

- **A geographically distinct regional population, or collection of populations; or**
- **A population, or collection of local populations, that occur within a particular bioregion.**

*Prasophyllum* sp. Wybong (C. Phelps ORG 5269) has not been recorded within the Proposed Modification Areas, however it has been recorded within the approved project disturbance area for the Mangoola Coal Project. There is potential habitat for the species within the Proposed Modification Areas, however it was not recorded during field surveys, despite these occurring within its known flowering period.

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**An action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:**

- **Lead to a long-term decrease in the size of a population;**

The project is not likely to lead to a long-term decrease in the size of a population of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269). This species has not been recorded within the Proposed Modification Areas, however it has been recorded within the approved project disturbance area for the Mangoola Coal Project.

- **Reduce the area of occupancy of the species;**

The project is not likely to reduce the area of occupancy of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269).

- **Fragment an existing population into two or more populations;**

The project is not likely to fragment a population of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) into two or more populations.

- **Adversely affect habitat critical to the survival of a species;**

The project is not likely to adversely affect habitat critical to the survival of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269).

- **Disrupt the breeding cycle of a population;**

The project is not likely to disrupt the breeding cycle of a population of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269).

- **Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**

The project is not likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) is likely to decline.

- **Result in invasive species that are harmful to a critically endangered species becoming established in the species' habitat;**

The project will not result in invasive species that are harmful to *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) becoming established in its habitat.

- **Introduce disease that may cause the species to decline; or**

The project will not introduce disease that may cause *Prasophyllum* sp. Wybong (C. Phelps ORG 5269) to decline.

- **Interfere with the recovery of the species.**

The project is unlikely to interfere with the recovery of *Prasophyllum* sp. Wybong (C. Phelps ORG 5269).

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## Vulnerable Species

The following EPBC Act listed vulnerable species are considered in this assessment:

- *Bothriochloa biloba*; and
- austral toadflax (*Thesium australe*).

An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

**In this case, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:**

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

*Bothriochloa biloba* was not recorded within the Proposed Modification Areas, however it has the potential to occur there. This species has been recorded extensively within the grassland habitats of the broader local area (Umwelt 2006, Umwelt 2009, Eastcoast Flora Surveys 2009a, 2009b), including within the additional biodiversity offset area. This species is likely to be relatively common within suitable grassland habitats of the local area. This species is moderately widespread, although uncommon, in the Hunter Valley. A population of this species within the Proposed Modification Areas would not represent a key source population for breeding or dispersal, nor would it be necessary for maintaining genetic diversity for the species. The Wybong area is not at the limit of the range of this species. As such, it is not likely that the potential habitat for *Bothriochloa biloba* within the Proposed Modification Areas would comprise habitat for an *important population* of this species.

Austral toadflax has not been recorded from the Proposed Modification Areas, however it has been recorded on one occasion in similar habitats from the Mangoola Coal Project area (Umwelt 2009). It is unlikely that this single record would comprise an *important population* of this species.

**An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:**

- **lead to a long-term decrease in the size of an important population of a species;**

The potential habitat for *Bothriochloa biloba* within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

The potential habitat for austral toadflax (*Thesium australe*) within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

- **reduce the area of occupancy of an important population, or;**

The potential habitat for *Bothriochloa biloba* within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

The potential habitat for austral toadflax (*Thesium australe*) within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

- 
- **fragment an existing important population into two or more populations, or;**

The potential habitat for *Bothriochloa biloba* within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

The potential habitat for austral toadflax (*Thesium australe*) within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

- **adversely affect habitat critical to the survival of a species, or;**

The project will not adversely affect habitat critical to the survival of *Bothriochloa biloba*.

The project will not adversely affect habitat critical to the survival of austral toadflax (*Thesium australe*).

- **disrupt the breeding cycle of an important population, or;**

The potential habitat for *Bothriochloa biloba* within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

The potential habitat for austral toadflax (*Thesium australe*) within the Proposed Modification Areas is not likely to comprise habitat for an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The project will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat for *Bothriochloa biloba* or austral toadflax (*Thesium australe*), such that these species are likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat, or;**

The project will not result in invasive species that are harmful to *Bothriochloa biloba* or austral toadflax (*Thesium australe*) becoming established in their habitat.

- **interferes substantially with the recovery of the species.**

The project will not interfere substantially with the recovery of *Bothriochloa biloba* or austral toadflax (*Thesium australe*).

## **Conclusion**

The project will not result in a significant impact on an *important population* of *Bothriochloa biloba*.

The project will not result in a significant impact on an *important population* of austral toadflax (*Thesium australe*).

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## Migratory Species

The rainbow bee-eater (*Merops ornatus*), white-bellied sea-eagle (*Haliaeetus leucogaster*), white-throated needletail (*Hirundapus caudacutus*), satin flycatcher (*Myiagra cyanoleuca*) and fork-tailed swift (*Apus pacificus*) are considered to have a reasonable likelihood of occurrence within the Proposed Modification Areas, as such have been included in this assessment. None were recorded within the Proposed Modification Areas, however they have been recorded in the local area, and have potential habitat present. An assessment in accordance with the DEWHA principal significant impact guidelines is provided below for these species.

**An area of *important habitat* is:**

- **habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; or**
- **habitat utilised by a migratory species which is at the limit of the species range; or**
- **habitat within an area where the species is declining.**

The Proposed Modification Areas is not regarded to comprise important habitat for any of the potentially-occurring listed migratory species, based on the criteria described above. As such, no further assessment is required for any EPBC Act listed migratory species.

## Conclusion

The project will not result in a significant impact on any EPBC Act listed threatened species or migratory species.